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Petroleum Engineer

Combined Edition

Drilling and Producing | Refining and Gas Processing | Oil and Gas Pipelining

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ble of Contents Page 3 • Advertisers' Index Page 6
EW MACHINERY AND SUPPLIES E-41

MARCH 1952

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These five 3,000-bbl. Hortonspheroids store natural gasoline at the Snyder, Texas gasoline plant operated by Sunray Oil Corporation. The Snyder plant is a cooperative project owned by 35 companies and 60 individuals in the Scurry County oil field.

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THE Petroleum Engineer

COMBINED EDITION

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MARCH, 1952 • VOLUME XXIV • NUMBER 3

GENERAL

Oil and Gas in the Uintah Basin of Utah A-41
Dorsey Hager

Piceance Creek Basin of Colorado a Portion of the Uintah Basin A-48
R. W. Blair and L. W. Heiny

Petroleum Possibilities in the Uintah Basin A-62
John R. Bunn

Oil and Utah A-76
J. R. McWilliams

Employees Vacation Spot E-1

Features

Course of Oil A-4
With the Editors A-8
Petrolic Personalities A-10
Dick Sneddon
Highlights in Oildom A-12
Meetings A-14
Letters to the Editors A-18
Petroleum Profile A-84
Robert M. Chan
General News E-2
General Personals E-10
The Petroleum Engineer's Continuous Tables E-13
(Installment No. 176)
Laugh with Barney E-20
Books E-22
Oil and Gas Trade News E-24
Trade Personals E-30
New Machinery and Supplies E-43
Trade Literature E-47

DRILLING AND PRODUCING

Weeks Island B-7
J. W. Pittman and J. E. R. Sheeler

Mud Trouble B-11
Ernestine Adams

Storm Damage at Ventura Avenue Field B-36

Canada Sets New Record B-40
H. G. Cochrane

Spraberry—Some Microscopic Characteristics B-54
W. A. Waldschmidt

Hollow Sucker Rods Aid Cleaning and Treating Techniques B-60
Richard Sneddon

Natural Water-Drive Conditions in Placedo B-65
S. F. Shaw

Spinning Drill Pipe B-70
W. W. Foster

A Mud Design for the Williston Basin B-72
R. D. Blaicher

Tank Battery Barge B-76

Morgan J. Davis Will Head AAPG for 1952 ..... B-81

Features

Editorial B-3
The Great Basins
Producing News B-84
What's Doing in Drilling B-90
Exploration Activities B-94
Running Tour With Men in the Industry B-100

REFINING AND GAS PROCESSING

Applied Psychology and Management C-3

Design of Gasoline Plants—Part 4 ..... C-5
O. L. Lewis

Desulfurization Makes Line-Gas in West Texas C-13
Arch L. Foster

Better Excess Flow Valves for Compressed Gases C-21
Doyle D. Buttolph and Harry R. Zeigler

Orthoflow Unit—New Feature of Refinery C-26
W. T. Ziegenhain

First Packaged TCC Unit on Stream C-31

New 30-Ton Sulfur Recovery Plant at Calgary C-33
Harry Chapin Plummer

The Technical Forum C-37
Fluidized Bed Reactor Applications
Calculation of Reid Vapor Pressure of Binary Blends

New Dunkirk Refinery C-39
V. S. Swaminathan

Plant Aids C-45
Controller for 24-Hr Gas Samples
How to Prevent a Ladder From Slipping
Dryer for Cobalt Moisture Tester and Sample Bomb
Pulsator on Solvent Dewaxing Unit

Features

Refining and Gas Processing News C-47
Refining and Gas Processing Personals C-52

OIL AND GAS PIPELINING

Refrigerated Extraction Plant Begins Operations D-3
J. J. King and R. V. Mertz

Crossing the Seine River D-12

Forethought and Taxes D-20
Iverson Walker

Crude Oil Gaging Techniques D-28
H. L. Pohl

Lubrication and Cooling Water in Diesel Operation D-34
W. F. Schaphorst

Microwave Communication Links D-35
Joseph Racker

Cathodic Protection of Pipe Underground D-46

Plastic and Glass Fiber Pipe Has New Basic Uses D-51

Helping to Meet the Demand for Fuel D-52

Features

Oil and Gas Pipelining News D-53
Pipe Line Personals D-59
Pipe Line Projects D-60
With the Pipe Line Contractors D-66

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the Course of OIL

FACTS ON PETROLEUM FINANCE

About two-thirds of the business of the petroleum industry of the United States is conducted by companies engaged in all its branches; the rest is carried on by units operating in only one or a few departments. The integrated companies are rarely self-sufficient, and this results in a continuous interchange of oil between them and those companies operating in only one department. The integrated companies are also larger than the others. Despite this fact, the largest integrated company produced only about 7 per cent and refined about 12 per cent of the total volume of crude oil handled in the United States during 1950. From this maximum companies range in size down to the single operator, of which there are tens of thousands embracing the entire industry.

Of the $15.3 billion of capital being employed at the close of 1950 by 30 oil companies representing more than two-thirds of the American petroleum industry, about 16 per cent represented borrowed capital and 84 per cent was invested capital derived in part from the reinvestment of earnings. Accordingly, only about one-sixth of the total capital employed by the petroleum industry is in the form of borrowings, a low ratio that is conducive to economic stability.

Corporate income of the oil industry during the last five years has been overstated because of the inadequacy of the current capital extinguishment charges to provide for the replacement at present high costs of properties and facilities that are being expended in current operations. Annual charges for depreciation, depletion, and amortization, which are deducted from earnings for the purpose of amortizing the carrying value of fixed assets during their estimated life are based upon original cost. However, current replacement costs are far above those that prevailed when present facilities were constructed or acquired. As a result current capital extinguishment charges are in most cases at a rate far below the provisions now needed for replacing similar assets. This inadequacy of charges causes an overstatement of reported net income. In effect, what has happened is that the petroleum industry has been selling its low cost productive assets, particularly crude oil reserves, and has been taking the profit into operating income and paying taxes on it without proper provision for replacement at current inflated rates.

The foregoing information is from an informative paper, "Capital Formation in the Petroleum Industry," by F. G. Coqueron and J. E. Pogue of the Chase National Bank, presented at the Annual Meeting of the Petroleum Branch of the A.I.M.E. in New York last month. As pointed out by the authors, the paper is a summary of data compiled for the last 10 years on the financial aspects of the petroleum industry of the United States. The data are based on the combined operations of a group of 30 representative oil companies that comprise more than two-thirds of the American petroleum industry and, as such, merit attention.

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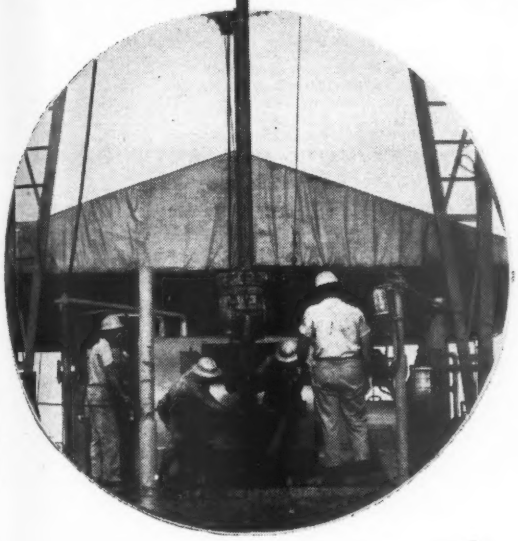

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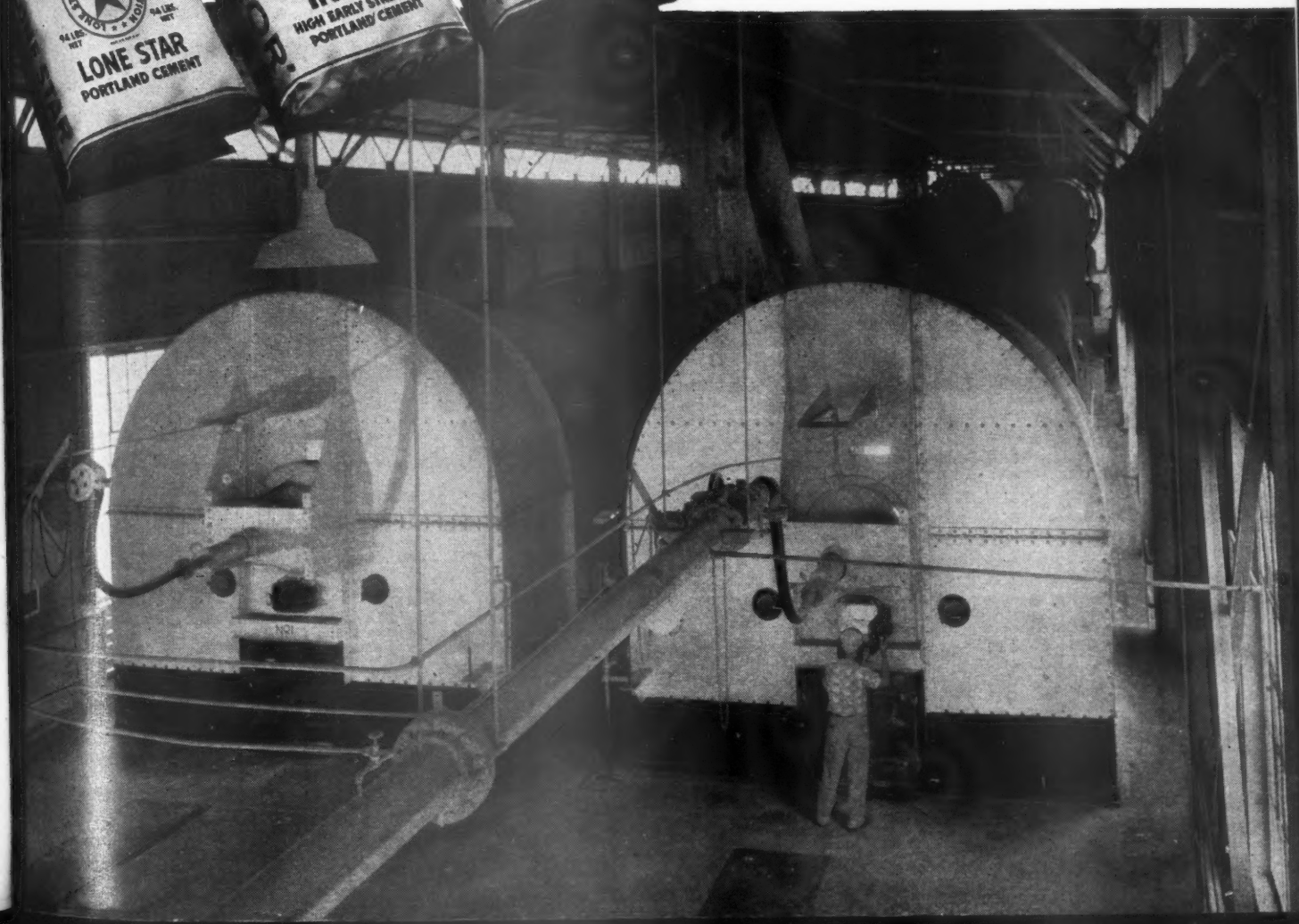

ADVERTISERS' INDEX

A

Abrams Aerial Survey Corporation D-44
Acme Fishing Tool Co. B-45
Aerofin Corporation A-34
Allis-Chalmers Tractor Division B-71
American Chain & Cable Co., Inc. E-27
American Foreign Insurance Association E-12
American Hoist & Derrick Co. B-70
American Iron & Machine Works Co. B-91
American-LaFrance-Foamite Corporation E-18
American Locomotive Company D-41
American Manufacturing Company of Texas A-2
American Recording Chart Co. A-18
American Sand-Banum Co., Inc. E-26
Armstrong Bros. Tool Co. E-29
Axelson Manufacturing Company B-69

B

B & W Incorporated B-87
Baash-Ross Tool Company B-97
Baker Oil Tools, Inc. B-4-B-5
Baroid Sales Division, National Lead Company B-59
Barrett Division, The D-2
Beaird, J. B., Company, Inc. B-75
Beaver Pipe Tools, Inc. E-49
Bennett, Chas. L. D-56
Bethlehem Supply Company B-77
Betz, W. H. & L. D. A-75
Birmingham Committee of 100 ..... E-38
Blaw-Knox Company A-57, A-74, E-9
Bowen, S. R., Co. B-55
Brewster Company, The B-43-B-44
Brown Fintube Co., The A-61
Bucyrus-Erie Company B-30
Buda Company, The B-64
Burgess-Manning Company E-14
Byron Jackson Co. B-34

C

Cable & Staples B-45
Cameron Iron Works, Inc. B-31
Cardwell Mfg. Co., Inc. B-56-B-57
Case, J. I., Co. A-72
Cast Iron Pipe Research Association C-54
Caterpillar Tractor Co. B-39
Chapman Valve Manufacturing Company A-36
Chicago Bridge & Iron Company ..... Inside Front Cover
Clark Bros. Co., Inc. E-4-E-5
Classified Advertisements E-7
Cleaner Pipelines Co. D-26
Cleveland Trencher Co. D-32
Cook, C. Lee, Mfg. Co., Inc. A-79
Cooper, Fred E., Inc. D-1
Cooper-Bessemer Corporation A-54-A-55
Core Laboratories, Inc. B-95
Crane Co. A-24
Crane Packing Company C-32
Curtin, W. H., & Co. C-46
Cutler-Hammer, Inc. A-77

D

Dallas Manufacturing & Sales Company D-40
Dean Brothers Pumps Inc. E-39
Dearborn Chemical Company D-61
Diamond Chain Company, Inc. B-49
Dow Chemical Company D-25
Dowell Incorporated A-40
Dresser Industries, Inc. B-15, B-46, B-48, D-13
Dresser Manufacturing Division D-13
Drilling & Service B-33
Drilling Specialties Company B-13
DuPont, E. I., de Nemours & Co. C-29-C-30

E

Electric Machinery Mfg. Company A-46-A-47
Electro Rust-Proofing Corp. (N. J.) D-34
Emsco Derrick & Equipment Company B-53
Ethyl Corporation C-11-C-12

F

Farrel-Birmingham Company, Inc. D-11
Fisher Governor Company A-69
Fluid Packed Pump Company B-61-B-62
Foxboro Company, The A-16a
France Packing Company A-37

G

Garlock Packing Company A-83
Gaso Pump & Burner Mfg. Co. A-16d
General Electric Company D-14-D-15
Geophysical Survey Syndicate B-74
Glass Fibers, Inc. D-34
Globe Oil Tools Company B-93
Grant Oil Tool Company B-96
Great Lakes Carbon Corporation B-19
Griscom-Russell Co., The A-39
Guiberson Corporation B-37

H

H & L Tooth Co. A-16c
H & M Pipe Beveling Machine Company D-58
Halliburton Oil Well Cementing Company ..... Back Cover, B-26
Harrisburg Steel Corporation E-34
Hercules Tool Company B-87
Houston Contracting Company D-47
Hughes Tool Company B-1
Humble Oil & Refining Company A-35
Hyatt Bearings Division, General Motors Corporation B-67

I

International Harvester Company A-23

J

Jensen Brothers Mfg. Co., Inc. B-92
Johns-Manville D-9
Johnston Testers, Inc. B-27
Jones, S. M., Company B-35

K

Kaiser Steel Corporation D-50
Kellogg, M. W., Company A-11
Kerotest Manufacturing Company C-40
Knudsen, Vic, Rigging Co. D-68
Koppers Company, Inc. A-59, D-65, E-21

L

Lane-Wells Company ..... Inside Back Cover, B-2, B-20, B-73, E-20
Larkin Packer Company, Inc. B-41
Layne & Bowler, Inc. E-23
LeBus International Engineers Limited B-51
Ledeen Mfg. Co. A-68
LeRoi Company A-70-A-71
Levingston Shipbuilding Co. B-68
Link-Belt Company B-23
Link-Belt Speeder Corporation D-27
Lone Star Cement Corporation A-5
Longhorn Industries, Inc. D-67
Lufkin Foundry & Machine Company B-17
Lufkin Rule Co. A-19

Mc

McCullough Tool Company B-101
McNamar Boiler & Tank Co. C-18

M

Macco Corporation D-45
Mack Trucks, Inc. A-63
Magnet Cove Barium Corporation B-15
Manning, Maxwell & Moore, Inc. D-43
Marley Company, Inc. A-32
Marsh Instrument Co. E-16
Martin, John N., Manufacturer B-74, B-87
Martin-Decker Corporation B-50
Master Tank & Welding D-7
Mercoid Corporation E-29
Miller Sand Pump Co. B-70
Minneapolis-Honeywell Regulator Co. D-21
Mission Manufacturing Company ..... Opp. B-88

N

National Aluminate Corporation C-2
National Supply Company, The A-49-A-52
National Tank Company E-50
National Tube Division A-33
Nelson Electric Manufacturing Co. E-33
Nicholson, W. H., & Co. E-44
Nicolet Industries, Inc. D-47
Nordstrom Valve Division ..... Front Cover
Norris, W. C., Manufacturer, Inc. A-1

O

Oakite Products, Inc. E-49
Oil & Petroleum Yearbook E-22
Oil Center Tool Company B-28
Oil Well Supply Division A-7
Orbit Valve Company C-17
Otis Pressure Control, Inc. B-89
Owens-Corning Fiberglas Corporation D-29

P

Pacific Coast Borax Co. E-32
Pacific Pumps, Inc. B-46
Parsons Company D-31, D-55
Patterson-Ballagh Division of Byron Jackson Co. B-103
Pelican Well Tool & Supply Co. D-56
Penberthy Injector Company E-37
Perrault Brothers E-26
Petro-Chem Development Co., Inc. A-13
Petroleum Electric Power Association A-30
Pewthers-Ditcher Company D-69
Pipe Line Development Company D-63
Pittsburgh Coke & Chemical Co. D-23
Plastex Pipe & Extrusion Company B-52
Powell, Wm., Co. C-20
Price, H. C., Co. D-36
Pritchard, J. F., & Co. A-73
Procon, Incorporated C-19
Pyle-National Company, The B-99, C-43

R

Radio Corporation of America A-16, D-37
Reading, Pratt & Cady Valve Division E-27
Rector Well Equipment Company, Inc. B-82
Reed Roller Bit Company B-6
Refinery Supply Company A-82
Republic Steel Corporation B-29, D-49
Ridge Tool Co. A-14
Rockwell Manufacturing Company A-16b, C-25
Roper, Geo. D., Corp. E-23
Rust-Oleum Corporation E-31

S

Schlumberger Well Surveying Corp. B-79
Security Engineering Co., Inc. B-48
Shaffer Tool Works B-47
Sharples Corporation D-33
Skinner, M. B., Company C-46, D-26
Smith, A. O., Corporation A-27, C-35
Southern Mill & Manufacturing Co. A-38
Spang & Co. E-35
Sperry-Sun Well Surveying Company B-32
Standard Magnesium Corporation D-39
Standard Oil Company of California A-26
Standard Pipeprotection, Inc. D-24
Sun Shipbuilding & Dry Dock Company C-1

T

Tapecoat Company D-48
Taylor Forge & Pipe Works A-81
Technical Oil Tool Corp., Ltd. B-21
Thompson Tool Co. E-6
Toledo Pipe Threading Machine Co. A-31
Tretolite Company B-24
Trojan Construction Co., Inc. D-62

U

Ultra-Violet Products, Inc. E-23
United States Rubber Company A-22
United States Steel Corporation A-7, A-33
Universal Concrete Pipe Co. D-40
Universal Oil Products Company C-44

V

Victaulic Company of America B-58
Visco Products Company, Inc. E-40

W

W-K-M Company D-19
Walker, W. L., Company D-38
Walker-Neer Machine Company B-80
Watson-Stillman A-9
Well Equipment Mfg. Corp. B-86
Western Gear Works D-17
Westinghouse Electric Corporation A-20-A-21
Wheland Company, The B-22
Whitney Chain Company ..... Opp. B-89
Wickes Boiler Co., The A-17
Williamson, T. D., Inc. D-70
Wilson, Web, Oil Tools, Inc. B-25
Wilson Supply Company B-98
Wisconsin Motor Corporation A-73
Worthington Pump & Machinery Corporation A-15, A-28-A-29
Wyatt Metal & Boiler Works A-16f

Y

Youngstown Sheet & Tube Company A-25

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USS "OILWELL"
UNITED STATES STEEL

With The EDITORS . . . . . .

New Practice School

Means whereby young student engineers may obtain a peep behind the curtain—the curtain between college and industry—has just been implemented by Tulane University authorities and Pan-Am Southern Corporation. This new plan inaugurates a practice school in which young engineers may work in refining plants, and get acquainted.

The course, as announced jointly by Roy J. Diwoky, Pan-Am executive vice president, and Dr. R. C. Harris, Tulane prexy, is offered as an optional to chemical engineering students during the last half of their senior year. The location of the school is at the refinery at Destrehan, a few miles upriver from New Orleans. Special quarters have been provided for the students in the refinery vicinity. School supervision is under Dr. M. M. Gilkerson, assistant chemical engineering professor at Tulane, along with Howard A. Parker who is director of the technical department of Pan-Am. Members of this technical department staff will be aides in the course. Students will receive 18 semester hours' credit for a 40-hour week.

No routine work will be done. Developmental or technical service problems associated directly with the plant's operation will be assigned for solution by the students.

Thus the industries of refining and of collegiate education collaborate in bridging the formerly very formidable chasm between formal training and plant problems. The Destrehan refinery has a fluid cat cracker, alkylation unit, fluid hydroformer, a delayed coking unit, (thermal cracker) all of which will introduce students to the newest in processing and so to the newest and most useful in processing problems, and how their solution is approached. It becomes an "interneship" for the young engineer.—A. L. F.

Of Interest to Pipeliners

It hasn't been so many years ago that the pipe line industry was more less neglected insofar as conventions were concerned. A convention-minded pipeliner, actually, didn't have very many meetings where discussions were especially along his line of interest. That situation is changed now, however, and the pipeliner can keep just as busy as anyone conventioning if he is so minded.

One of the outstanding pipe line meetings, the annual convention of the Pipe Line Contractors Association, was recently held in Houston, Texas, but the season is just getting under way. Some of the meetings that will be held during the spring months are strictly for pipeliners, others are associations or societies that devote a definite and important part of their programs to pipe line subjects. Here are some, mentioned in the order held, that will be well worthwhile considering:

March 5 and 6—Pacific Coast Gas Association. Fresno, California. This meeting always presents a number of papers that are beneficial to operators of gas pipe lines.

March 10-14—National Association of Corrosion Engineers, Galveston, Texas. This annual meeting is for all who have a corrosion problem, but has an important place for pipe line corrosion engineers.

April 14-17—Petroleum Industry Electrical Association, Tulsa, Oklahoma. Electrical men in all branches of the petroleum industry will be interested in this gathering, but it is notable that this year's program contains more than usual aimed at pipe line communications men.

April 21-23—American Petroleum Institute Division of Transportation, Products Pipe Line Conference, Fort Worth, Texas. This is only the third of these conferences but already they are accepted as one of the most important of pipe line meetings. The get-together in Fort Worth should prove altogether as beneficial as the one last year in Atlanta and the one the year before in St. Louis.

April 21-24—American Petroleum Institute Safety and Fire Protection Committees, Fort Worth, Texas. Held at the same time and in the same city as the Products Pipe Line Conference, it will give those interested in this phase of pipe line operations to take advantage of some of the meetings.

April 28-30—Southern Gas Association, Galveston, Texas. Since this association added a gas line section two years ago the number of pipe line people attending has increased steadily. The programs, too, are assuming greater and greater importance.

May 12-13—American Gas Association, Natural Gas Department, Los Angeles, California. For gas pipe line men this is always a good meeting. AGA with its PAR program unfailingly has reports to make on technological and operating developments.

May 27-29—Southwestern Gas Measurement Short Course, Norman, Oklahoma. Held under the auspices of the University of Oklahoma, this course for years has attracted the best measurement men in the business. Many of the latter are among the instructors and newer men can gain much from attending their classes and asking questions.—F. H. L.

What Cost Synthetic "Gas"

During an exceedingly busy day with PAD the National Petroleum Council took time out to take issue with an estimate by the Bureau of Mines that to a great majority of people is decidedly misleading. Especially is it misleading to the general public. Often these figures by Federal agencies are hedged about in the context of the dissertation in such manner that, if we grant the validity of the basis for estimation, the figures may not be too far out of line. It is typical, however, for speakers and writers to be brief by quoting only the round figures to give a sadly mistaken idea.

In the instance referred to, the Council states that instead of costing about 12 cents per gallon to produce synthetic motor fuel, as the estimate claims, the cost will be nearer to 41 cents per gallon. The Council doubtless meant an overall cost covering all factors that the production must carry; direct manufacturing costs, amortization, interest on money used, royalties, handling, taxes, insurances, and TAXES. Too often Federal estimate figures are limited by some such expression as "before taxes, insurance, or profits on investments, etc." Such a basis is meaningless or seriously misleading if no taxes nor insurance nor amortization nor royalties are considered in arriving at the cost.

Therefore estimates based on such artificial limitations can be made only for comparison under political conditions that we believe the great majority of people in this country abhor.

Then why make such estimates on such bases? Why not be realistic and base them on conditions under the government of a real republic such as our own, and not to show the fictitious "advantages" obtainable under the other set of conditions?—A. L. F.

They're DROP FORGED

of STEEL...

W-S Screw-End and Socket-Weld Fittings

There are several big benefits to you implied in this simple statement of fact about W-S Fittings.

First, forging means *strength*—the strongest, most compact physical form, steel for steel, obtainable by commercial methods of fabrication.

Second, *being* stronger, forged fittings are much *smaller* and *lighter*, size for size, than other types.

Third, *dimensional accuracy* is characteristic of the forging process—and because forged bodies *are* more accurate, they chuck better, can be machined to *closer*, more *uniform tolerances* than other types.

To these inherent advantages of *forged* fittings, add Watson-Stillman's modern manufacturing facilities, a production control system that's air-tight from furnace to finished product, and a sales engineering staff dedicated to SERVICE in the largest sense of the word. The total is heavily weighted in favor of the advantages of W-S Double-Diamond Forged Steel Fittings.

• Lower Service Cost • More Uniform
• Stronger • Smaller • Lighter • Tighter

SOLD THROUGH LEADING DISTRIBUTORS . . . EVERYWHERE

WATSON-STILLMAN
ESTABLISHED 1848

W-S

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DISTRIBUTOR PRODUCTS DIVISION

ROSELLE, NEW JERSEY

Designers and Manufacturers of Forged Steel Fittings, Wire Rope Shears, Hand Pumps, Jacks, Pipe Benders and Hydraulic Equipment

PETROLIC PERSONALITIES

DICK SNEDDON

LANSING ON THE MOVE AGAIN

We had a nice visit a short time ago with Sanford G. "Sandy" Lansing, the energetic and entertaining prexy of Socony Paint Products Company, whose headquarters are in Metuchen, New Jersey, but who is obviously at home anywhere. By the time this is in print he will be down in Honolulu, basking on the sands, and watching the waving of the palms and sundry female anatomical accoutrements that also wave in a distinctly interesting manner. Sandy, according to our Metuchen operative, is himself as restless as the waters of Waikiki, and we especially noticed on the occasion of our meeting that his western representative, Art White, a normally lively and eager sort of a chap who was also present, looked as if he had just been badly beaten in a Golden Gloves contest or had been kicked around inside of a ball mill. This, we learned later was the normal result of trying to maintain the Lansing pace, which is pretty much of an impossibility for anyone but Sandy.

Speaking of Golden Gloves reminds us that the Metuchen magnate was a pretty sharp amateur boxer in his college days but he gave it up when he discovered that after a bout he had difficulty getting about, if you know what we mean. Although Sandy received a good solid grounding in mathematics at Cornell he still has no luck in his attempts to balance his check book. This is largely because of his failure to recollect certain elusive items, which he terms "deeducts", and the circumstance brings him no end of embarrassment. He is the master of an expansive vocabulary that makes the Roget Thesaurus look positively anemic, and his colorful disquisitions on this and that make very interesting listening.

FORSAKES THE EAST COAST FOR THE WEST

Ox Morgan, the eminent New Yorker, has pulled stakes and hied him back to the West Coast. His place as export manager for Byron-Jackson will be taken by Earl Rees, export manager of the Patterson-Ballagh division of B-J. Earl was just recently elected president of the Los Angeles Chapter Nomads and we were looking forward to a good year under his direction. He is mighty nice people, a good performer oratorically, and we can thoroughly recommend him to the natives of New Amsterdam.

Bob Roberts, the Shell Company pipe line chief out in California is back home after being hospitalized at Carmel for some time with a serious illness. He is getting along nicely which is right good news. Melvin Hill of Western Gulf Oil Company has been appointed assistant general chairman of the arrangements committee for the joint convention of AAPG, SEPM, and SEG in Los Angeles, March 24-27. He replaces Sam Stewart who was moved to Calgary to take care of Richfield Oil Corporation's geological affairs up there.

FROM TEXAS TO CALIFORNIA

Another recent arrival in Los Angeles from Houston, Texas, and here to stay, is Ed Keatly, who has come to the glamor metropolis to take over as west coast manager for the Alcorn Combustion Company. Ed is a native of Wilmington, Delaware, a lovely village in which we spent many happy moons during the second world war building an ammonia plant for the Hercules Company and getting acquainted with a fairish proportion of the population of Ireland. He attended Drexel Technical Institute in Philadelphia, known back there at D.I.T., and immediately thereafter started to work with Alcorn in their local plant.

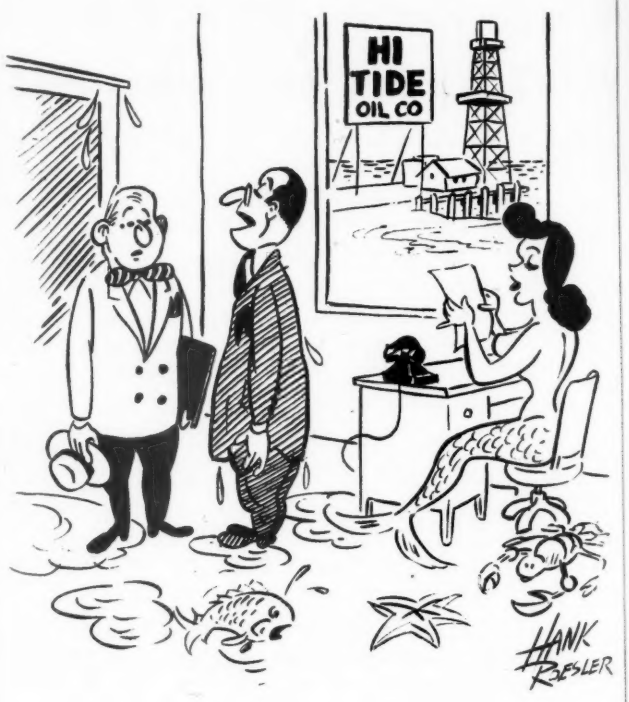
In due course he forged his way to management posts via the purchasing and sales route, meanwhile garnering a wealth of experience in Pennsylvania, Oklahoma, Texas, and other oil states. He travels widely and likes it; has visited refineries in all parts of the country; and is never happier than when he has a refinery scene is his viewfinder and some color film in his camera. We found him just after his arrival here in the company of Fred Currie, the Copperweld executive, who is a close friend of Frank Praeger, president of the Alcorn Combustion Company. To Ed and this organization, good luck as they settle down in the land of very nearly perpetual sunshine.

ARNOLD SPORTS "I TOLD YOU SO" ATTITUDE

From Pensacola, Florida, comes an illuminating bit of chitchat from Ralph Arnold, the noted western geologist. A short time ago he was bemoaning the fact that there wasn't a kindred soul in his vicinity and he was feeling bluer than a widow's grey hair with nobody around to talk to about cherty shales, down thrusts, and fault blocks. Then Humble Oil and Refining Company brought in a 29 gravity gusher near Pollard, Escambia County, Alabama, just about four miles from the Florida line, and now Ralph can't breathe, so tightly is he wedged in by oil scouts, lease hounds, drilling contractors, equipment salesmen, and land prospectors. Despite the discomfort of all this congestion, however, his sufferings are not at all unbearable.

As a matter of fact he has been touting this particular territory for a number of years in the face of a great deal of skepticism and now that it has turned out even better than he had hoped, he is enjoying that old "Didn't I tell you?" feeling. Ralph Arnold, for the benefit of the uninitiated, has more academic honors than anyone we know. As a matter of fact, it is said that he was finally asked by the Government to stop studying in order to avert a dangerous shortage of sheepskin.

ON THE OIL FRONT



"We like to keep our offices close to our operations."

Toughness built in for a tough exchange job!

To master temperature, pressure and chemicals use

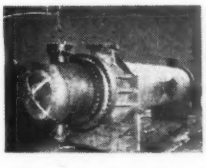
M. W. KELLOGG process equipment

This 8 foot diameter tube sheet is for a recycle-catalyst cooler on a giant cat-cracker. Tons of erosive powder will pour through the cooler's tubes in minutes as it controls regenerated catalyst temperature. Kellogg's exclusive fabricating techniques really pay off in equipment for such tough processing jobs.

Pressure Vessels
Vacuum Vessels
Fractionating Columns
Drums and Shells
Heat Exchangers
Process Piping
Hi-pressure—Hi-temp Power Piping
Bends and Headers
Forged and Welded Fittings
Radial Brick Chimneys

Continuing Basic Study of heat exchange by Kellogg development groups over 20 years has produced unduplicated design data.

Shop Layout Craftsmen have had experience on all types of heat exchangers, from marine condensers to jet engine combustion-chambers.



Rigid Quality Control is maintained by inspectors reporting directly to *Shop Management* rather than to *Production* executives.

Extensive Shop Facilities, from plate forming to stud threading, permit *complete* fabrication of any type heat exchanger

Special Shop Techniques—the component parts of each exchanger are fabricated as a production unit, building in the advantages of "tailor-made" fit.

FOR OPERATORS IN WESTERN CANADA!

The Canadian Kellogg Company Ltd. has established complete shop facilities for the fabrication of all types of piping at **EDMONTON**, Alberta. Inquire directly or through any Kellogg or Canadian Kellogg office.

The M. W. Kellogg Company *(A Subsidiary of Pullman Incorporated)* **New York, Jersey City, Los Angeles, Tulsa, Houston, Toronto, London, Paris**

HIGHLIGHTS IN OILDOM

OPPOSES OIL PRICE CEILINGS

In a report to the Independent Petroleum Association of America, Russell B. Brown, general counsel, has declared that there is no reason for an extension of the defense production act, which expires June 30. The act authorizes programs for allocation of strategic materials and for establishment of ceiling prices, and the President has asked for a two-year extension. Brown asserted that one of the several conditions required for imposition of ceilings is an increase or threatened increase in prices of a commodity above the May 24 to June 24, 1950 period. He declared, "There existed no reason or authority for the imposition of controls so far as crude petroleum is concerned." He added that the last increase in the price of crude was December 6, 1947, when it was raised approximately 50 cents per barrel to bring the figure to $2.56 per barrel for the average grade.

KANSAS OIL VALUE UP IN 1951

The state geological survey at Kansas University has reported that the annual value of raw materials produced in that state in 1951 exceeded $400,000,000 for the first time in the state's history. The 1951 value reached $405,300,000, compared with at least $25,000,000 more than the value of 1950. Mineral fuels gained about 6½ per cent last year. Value of crude oil produced was estimated at $293,000,000, up 6 per cent; natural gas, $34,000,000, up 8 per cent; and natural gasoline and liquefied petroleum gases, $11,700,000, up about 20 per cent. More than 150 oil and gas pools were discovered in Kansas last year, and there was considerable expansion in refining and pipe line construction.

INFLATION PAY HIKE RESULT: FAIRLESS

The question before the Wage Stabilization Board is whether or not this nation can enjoy another year of industrial peace without having to foot the bill for another disastrous round of inflation. Benjamin F. Fairless, president of United States Steel, said in defense of the steel companies' dispute with the union over its recent demand for higher wages. Speaking before a special panel of the board in the meeting room of the New York Bar Association Building, Fairless said four undeniable facts are vitally important to an understanding of this case:

"First, this is more than a mere wage dispute between the union and the companies . . . It is clearly a contest between the union and the government over wage control policies.

"Second, the real issue at stake here is whether the Economic Stabilization program is to be maintained, relaxed, or radically revised.

"Third, this attempt to upset the government's Economic Stabilization Program has not been undertaken by the steelworkers union alone, but is the fixed and resolute policy of the entire CIO as expressed at its convention.

"And fourth, it is therefore evident that any wage increase or other labor benefit that may be recommended by this panel, or by the board, will not be confined to the steel industry by any means, but will spread to all industry."

OIL WORKERS SET STRIKE

Oil Workers International Union (CIO) have set March 3 as strike date, in an attempt to force a general $2 daily pay hike from the oil industry. Although CIO workers are engaged in all phases of the oil industry, major concentration is refining, and one spokesman, who declined to give his name, has reported that a strike would slash Texas refining 60 per cent. Texas refineries represent about 28 per cent of the nation's refining.

USSR REPORTS OIL OUTPUT RISE

The Soviet Government publication *Izvestia* has reported that production of crude oil in USSR increased 4,500,000 tons in 1951, or 31,500,000 bbl, a daily rise of 86,000 bbl a day. Crude oil output in 1950 was estimated at 37,800,000 tons (264,600,000 bbl) by the Research and Planning Division of the United Nations Economic Commission for Europe. An estimate of 1951 production from these figures would be 296,000,000 production for the year or an average of 811,000 bbl a day.

OIL RESERVES FIGURED IN OIL ECONOMY

For every dollar's worth of oil sold to date (43.1 billion barrels) the industry has spent $1.30, according to H. J. Struth, petroleum economist, in the Core Laboratories, Inc's., "Petroleum Newsletter". Struth states further that if we "use the cumulative production as a divisor, total expenditures involved in oil production have averaged $1.86 per barrel, against an average selling price at the wells of $1.43. If none of the remaining oil reserves were recovered, it would mean a primary loss of 43 cents per barrel, however, if they are recovered in the future, it would represent an average investment of 70 cents per barrel". Struth summarizes the foundation of these figures as follows:

Crude oil produced to date	43.1 billion bbl
Average price at wells	$1.43
Total value of production	$61.7 billion
Oil wells and dry holes drilled	1,224,442
Drilling cost at $30,000	$36.7 billion
Other costs—lifting, leasing exploration, etc	$43.6 billion
Total cost to date	$80.3 billion
Unrecovered investment	$18.6 billion
Estimated reserves, 12-31-51	26.5 billion bbl
Investment per barrel	70 cents

TIDELANDS EDUCATION DRIVE ON

Texas officials have been holding a month long campaign of education on the tidelands issue, with Governor Allen Shivers leading the campaign. Motto for the group is "Remember the Tidelands", and the state's claim to the tidelands is being pressed on the people of Texas. A nationwide campaign is also underway. Speaking in a radio address, Governor Shivers remarked, "Texas, California, and Louisiana are the only states that have been sued by the federal government for their tidelands. It might be more than a coincidence that these are the only three states that have struck oil in their offshore waters."

COAL INTERESTS FIGHT GAS IMPORT

The coal interests in Washington led by Representative Flood and Thomas Kennedy, vice president of the United Mine Workers, are protesting importation of natural gas from Canada into Montana. They contend there is enough fuel in this country to meet demand, and point out the fact that there is considerable unemployment in Pennsylvania's hard coal regions. The application by Montana Power Company, if passed by Federal Power Commission and the President, would bring in some 10 billion cubic feet of natural gas a year for 5 years.

IRAN, WORLD BANK TALKS END

A five-man group, made up of representatives of the International Bank for Reconstruction and Development, are returning to Washington from Tehran, where they have been conferring with Premier Mossadegh. It has been reported that a partial agreement had been reached with Mossadegh, but was not announced just how much he had accepted. The main part of the plan was a proposal for the bank to manage the Iranian oil industry temporarily. This would let Iran receive much-needed revenues from its oil and make it available to western users while a final settlement is being reached with Britain over nationalization of British-owned oil facilities in Iran.

CHAPMAN PRAISES SCRAP COLLECTION

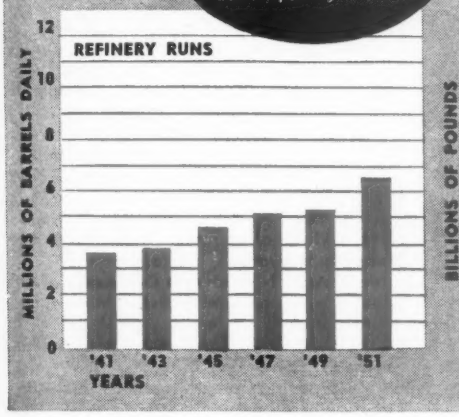
Oil and gas industry efforts in increasing scrap collection have been hailed by Secretary of the Interior Oscar L. Chapman as "a significant contribution to an important part of the defense effort." Commenting on favorable responses by various segments of the industry to a recent urgent appeal from the Petroleum Administration for Defense for intensified scrap drives, Secretary Chapman said:

"These responses indicate a growing awareness on the part of the industry of the seriousness of the scrap shortage."

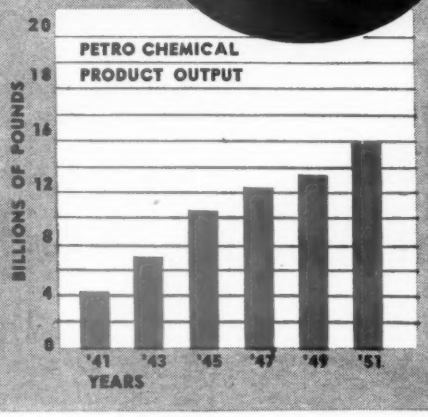
CONFIDENCE spells growth

There's many a reason for the parallel growth of the Petro Chemical Industry and the increasing use of Petro-Chem Iso-Flow Furnaces by leading Petro Chemical Companies.

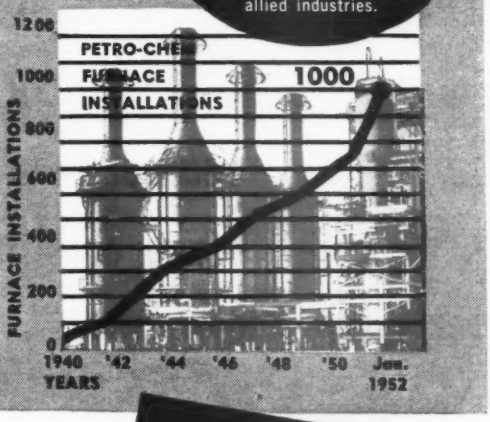
Runs to stills in U. S. oil refineries increased from 3 million 500 thousand barrels per day in 1940 to more than 6 million 500 thousand barrels per day in 1951.



Petro Chemical production has increased from 4 billion pounds in 1940 to more than 16 billion pounds in 1951.



In 1940 there was 1 In 1946 there were 400 and as of Feb 1952 there are more than 1000 Petro-Chem Iso-Flow Furnaces performing in the petroleum, chemical and allied industries.

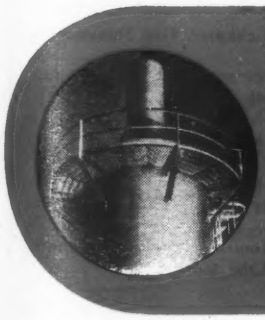


ISO-FLOW FURNACE USERS KNOW . . . that the Petro-Chem Development Company has but one basic product; processing furnaces for petroleum, chemical and allied industries. As a result of experience, they know that it does not pay to build their own furnaces; that Petro-Chem Iso-Flow Furnaces cost less, operate efficiently and usually beyond their rated capacity . . . *they know that all process data made available for the design and engineering of Petro-Chem Iso-Flow Furnaces is kept strictly confidential . . . never released by Petro-Chem Development Company engineers.*

The Petro Chemical, Petroleum, Chemical and allied industries can be confident that as they grow in size and advance in technology, so Petro-Chem Iso-Flow Furnaces will keep pace.

There's a **PETRO-CHEM ISO-FLOW FURNACE** *for every process requirement of the petroleum and chemical industries*

for any | DUTY TEMPERATURE PRESSURE EFFICIENCY



PETRO-CHEM ISO-FLOW FURNACES

UNLIMITED IN SIZE . . . CAPACITY . . . DUTY

PETRO-CHEM DEVELOPMENT CO., INCORPORATED

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Bethlehem Supply, Tulsa and Houston · Flagg, Brackett & Durgin, Boston · D. D. Foster, Pittsburgh
Faville-Levally, Chicago · Lester Oberholtz, California · Gordon D. Hardin, Louisville, Kentucky

To obtain more information on products advertised see page E-41

It's a cinch to ream pipe with this RIDGID

Extra-long-taper reamer won't thin, flare or split pipe

● RIDGID LonGrip reamers have that extra-long-taper that cleans the burr smoothly out of pipe or conduit almost without effort. Just a few light ratcheted strokes do the job. Furnished complete with ratchet handle. No. 2 Reamer unit sold separately for use in RIDGID 00R small ratchet die handle. Two sizes, No. 2, ⅛" to 2" pipe; No. 3, ⅜" to 3" pipe. These RIDGID new type pipe reamers really do save your time, work—and pipe. Ask for them at your Supply House.

Buy reamer complete or reamer unit separately for use with 00R die handle.

RIDGID

★ Work-Saver Pipe Tools ★

THE RIDGE TOOL CO. • ELYRIA, OHIO

MEETINGS

March 5-6—**Pacific Coast Gas Association,** Fresno, California.

March 5-7—**American Petroleum Institute,** division of production, Southwest district, Washington-Youree, Shreveport, Louisiana.

March 10-14—**National Association of Corrosion Engineers,** annual conference, Galveston Pleasure Pier and Buccaneer Hotel, Galveston, Texas.

March 11-14—**Plastics Exposition,** fifth national, Exposition Hall, Philadelphia, Penna.

March 12—**Institute of Petroleum,** Manson House, 26, Portland Place, W. 1., London.

March 14-15—**Petroleum Engineering Management Conference,** North Campus, University of Oklahoma, Norman.

March 16-19—**American Institute of Chemical Engineers,** regional meeting, Biltmore Hotel, Atlanta, Georgia.

March 19-21—**American Petroleum Institute,** division of production, Mid-Continent district, Hotel Broadview, Wichita, Kansas.

March 22-April 6—**International Trade Fair,** Navy Pier, Chicago, Illinois.

March 23-27—**American Association of Petroleum Geologists, Society of Economic Paleontologists and Mineralogists, Society of Exploration Geophysicists,** annual joint meeting, Biltmore Hotel, Los Angeles.

March 26—**Institute of Petroleum,** Manson House, 26, Portland Place, W. 1., London.

March 27-28—**Texas Independent Producers and Royalty Owners Association,** sixth annual meeting, Hotel Texas, Fort Worth.

March 29—**North Texas Oil and Gas Association,** Kemp Hotel, Wichita Falls, Texas.

March 31-April 2—**Western Petroleum Refiners Association,** annual meeting, Plaza Hotel, San Antonio, Texas.

March 31-April 2—**American Chemical Society,** division of petroleum chemistry, annual meeting, Milwaukee, Wisconsin.

March 31-April 2—**Midwest Gas Association,** annual meeting, Hotel Radisson, Minneapolis, Minnesota.

April 2-3—**Pacific Coast Gas Association,** Berkeley, California.

April 2-4—**American Petroleum Institute,** division of production, Eastern district, Hotel William Penn, Pittsburgh, Pennsylvania.

April 3-5—**Short Course in Fundamentals of Lubricating Materials,** Case Institute of Technology and ASLE, Cleveland, Ohio.

April 7-9—**American Society of Lubrication Engineers,** annual meeting, Statler Hotel, Cleveland, Ohio.

April 14-17—**Petroleum Industry Electrical Association,** annual meeting, Mayo Hotel, Tulsa, Oklahoma.

April 16-18—**National Petroleum Association,** semi-annual meeting, Hotel Cleveland, Cleveland, Ohio.

April 21-23—**American Petroleum Institute,** division of transportation, pipe line meeting, The Blackstone Hotel, Fort Worth, Texas.

DESK AND DERRICK CLUB

Dallas, Texas chapter, First Thursday of the Month.

Houston, Texas chapter, First Thursday of the Month.

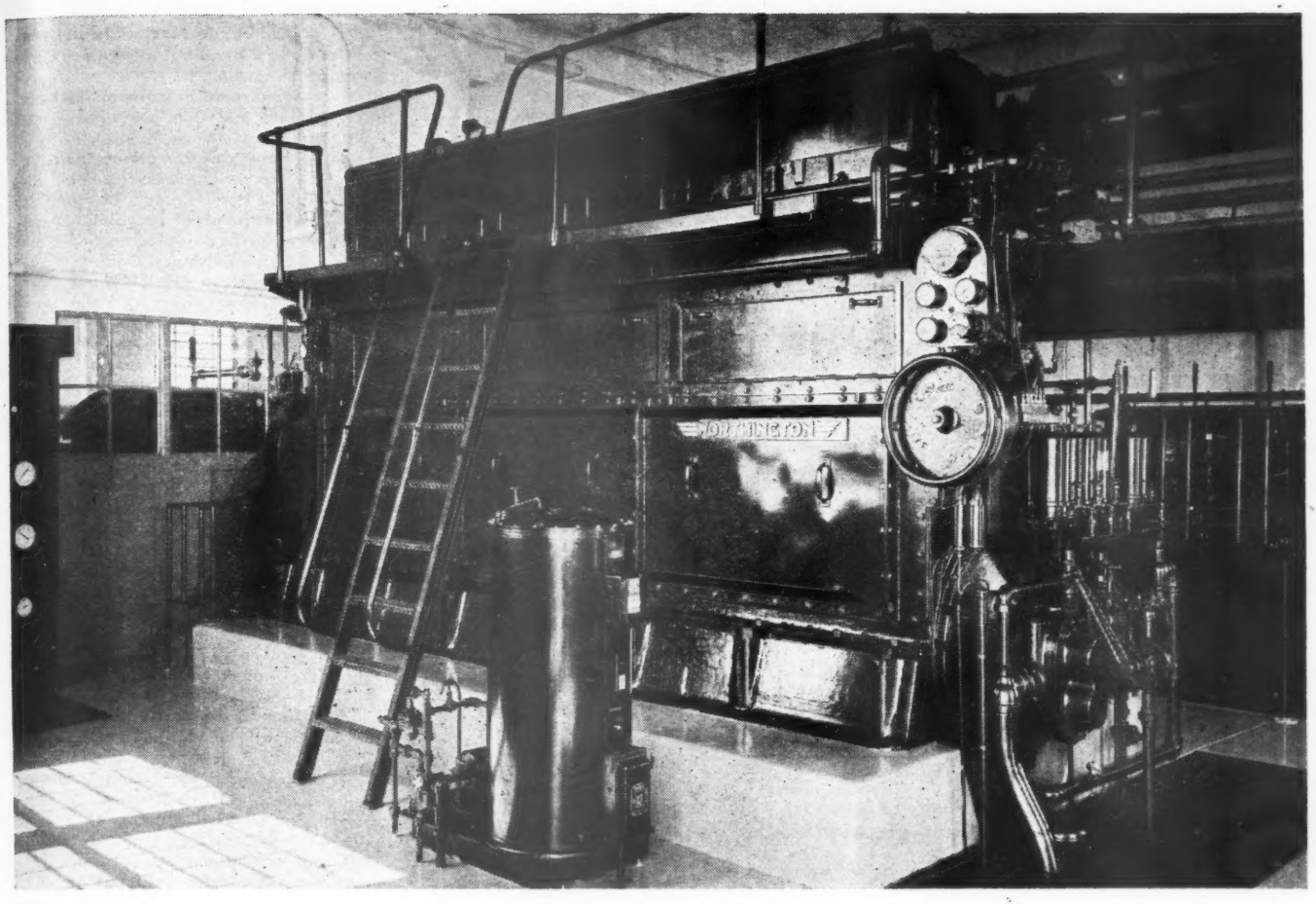
Jackson, Mississippi chapter, Third Tuesday of the Month.

Los Angeles, California chapter, Third chapter of the Month.

Odessa, Texas chapter, First Monday of the Month.

Shreveport, Louisiana chapter, Second Tuesday of the Month.

To obtain more information on products advertised see page E-41



No Standby Needed

Worthington Reliability Saves Thousands of Dollars in Investment Cost

Here's one of twelve Worthington Diesel engines used exclusively on a large oil pipe line running across Texas.

They power the pumps which maintain a constant flow of crude oil from field to refinery.

In none of the pumping stations is there a standby engine. The pipeline company is confident that its Worthington Diesels will *stay on the job.*

Portable pumping units are connected into the line during routine maintenance checks.

Engine fuel is raw crude bled from the line. This is a severe application. But Worthington—one of the first to utilize crude for Diesels—knows how to lick the problem.

For any engine application, call on Worthington—an engine for any fuel: oil (crude or regular), gas or "dual fuel". Worthington's complete line of engines assures you of the most economical operation no matter what fuel you use.

For further information, write Worthington Pump and Machinery Corporation, Engine Division, Buffalo, New York.

WORTHINGTON

ENGINES

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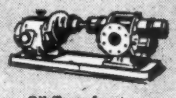
ECONOMICAL CONTINUOUS POWER

Diesel Engines, 150 to 2640 hp
Gas Engines, 190 to 2880 hp
Dual Fuel Engines, 345 to 2640 hp

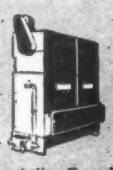
WORTHINGTON-BUILT AUXILIARIES

Engine Starting Compressors

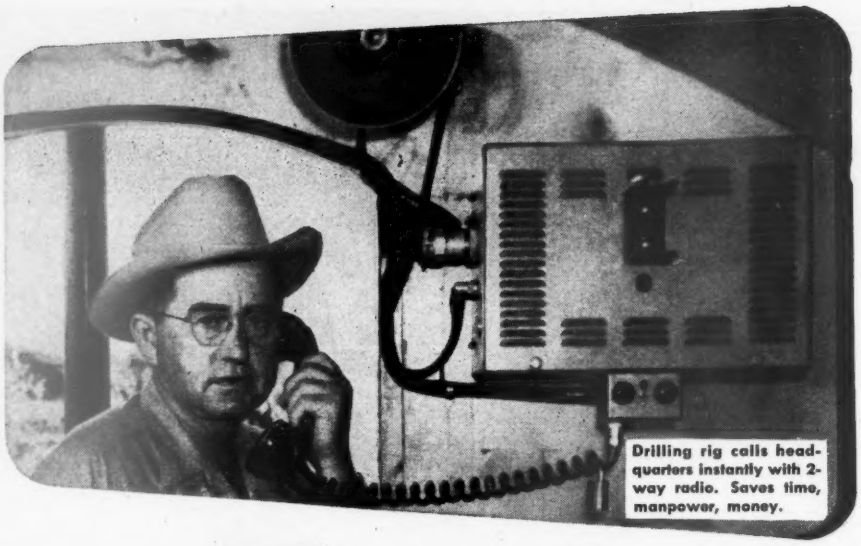


Oil Transfer Pumps

Cooling Water Circulating Pumps



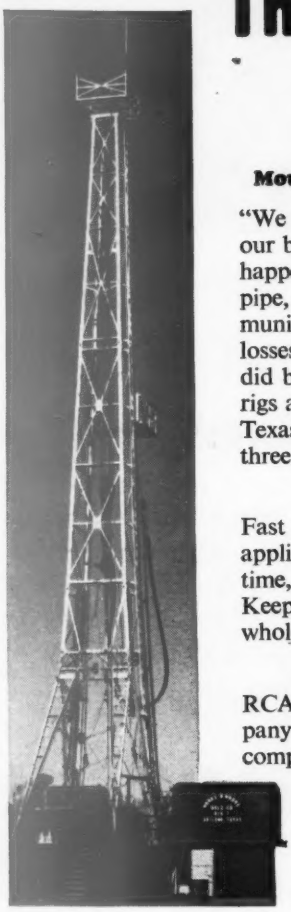
Evaporative Type Engine Water Coolers



Drilling rig calls headquarters instantly with 2-way radio. Saves time, manpower, money.

"RCA 2-WAY RADIO Saves Us Thousands of Dollars Each Year"

says Lamar H. Moore, President, Moutray-Moore Drilling Company of Abilene, Texas



"We save money every day on our routine operations, but our biggest saving is when things go wrong at the rigs. This happens frequently. Broken mud lines, twist-offs, stuck drill pipe, equipment trouble . . . these are only a few. Fast communications can prevent what might otherwise be heavy losses, especially on fishing jobs. I don't know how we ever did business without 2-way radio. We are now operating 5 rigs and a fleet of cars within a 100-mile radius of Abilene, Texas. These units can contact our base station with its three remote operating points 24 hours a day."

Radio works "miracles" every day

Fast action is typical of RCA 2-way radio wherever it's applied. Puts a "phone" in every auto, truck, or rig. Saves time, manpower, money. Saves gas and oil, wear and tear. Keeps contact with field forces day and night. Speeds up whole operation.

Radio easy to install—operate—maintain

RCA helps you set up 2-way radio. And RCA Service Company handles service and installation if desired. Lightweight, compact mobile unit can be installed in only 4 hours. Easily maintained, uses standard tubes. Exceeds FCC requirements. Central transmitter serves any number of mobile units within service area. Designed and backed by RCA, world leader in radio. See how radio can save *you* money. For full story, mail coupon TODAY!

Dept. 127C, RCA Engineering Products, Camden, N. J.
Please send my FREE copy of illustrated booklet "RCA 2-Way Radio for Industry."

Name_____ Title_____

Company_____

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RADIO CORPORATION of AMERICA

April 21-24—**Convegno Nazionale del Metano and del Petrolio,** (National petroleum convention) Taormina, Italy.

April 21-24—**American Petroleum Institute,** safety and fire protection committees, Hotel Texas, Fort Worth, Texas.

April 24-25—**American Petroleum Institute,** division of production, Rocky Mountain district, Gladstone Hotel, Casper, Wyoming.

April 28-29—**Independent Petroleum Association of America,** midyear meeting, Deshler-Wallick Hotel, Columbus, Ohio.

April 28-30—**American Oil Chemists Society,** spring meeting, Shamrock Hotel, Houston, Texas.

April 28-30—**Southern Gas Association,** annual convention, Galveston, Texas.

April 29-30—**American Petroleum Institute,** Board of Directors and executive committee, Mayo Hotel, Tulsa, Oklahoma.

April 30-May 1, 2—**National Gasoline Association of America,** annual convention, Rice Hotel, Houston, Texas.

May 5-7—**American Geophysical Union,** National Academy of Sciences and National Research Council, Washington, D. C.

May 7-9—**Industrial Waste Conference,** Purdue University, Lafayette, Indiana.

May 9-10—**Interstate Oil Compact Commission,** spring meeting, Phoenix, Arizona.

May 11-14—**American Institute of Chemical Engineers,** regional meeting, French Lick Springs Hotel, French Lick, Indiana.

May 12-13—**American Gas Association,** natural gas department spring meeting, Biltmore Hotel, Los Angeles, California.

May 12-15—**American Petroleum Institute,** refining division midyear meeting, St. Francis Hotel, San Francisco, California.

May 15-16—**American Petroleum Institute,** division of production, Pacific Coast, Biltmore Hotel, Los Angeles, California.

May 21-23—**Oil Industry Information Committee,** St. Francis Hotel, San Francisco.

May 26-28—**American Gas Association,** production and chemical conference, Hotel New Yorker, New York City, N. Y.

May 27-29—**Southwestern Gas Measurement Short Course,** University of Oklahoma, north campus, Norman, Oklahoma.

May 28-30—**Short Course in Gas Technology,** seventh annual, Texas College of Arts and Sciences, Kingsville, Texas.

June 5-6—**Pennsylvania Grade Crude Oil Association,** annual meeting, Hotel William Penn, Pittsburgh, Pennsylvania.

June 8-12—**Canadian Gas Association,** Chateau Frontenac, Quebec City, Canada.

June 9-14—**American Petroleum Institute,** midyear standardization conference, Brown Plaza Hotel, Denver, Colorado.

June 23-27—**American Society for Testing Materials,** annual meeting, Hotels Statler and New York, New York City, New York.

NOMADS TO MEET

New York, N. Y., Chapter, First Monday of the Month, Louis Sherry's, New York. Secretary Fred J. Jobst, c/o Val A. Wittich, Jr., 30 Rockefeller Plaza, New York 20, New York.

Houston Chapter, Second Monday of the Month, Ye Olde College Inn, Houston, Texas. Secretary E. F. Baldwin, Hughes Tool Company, Box 2539, Houston, Texas. WO-3101.

Los Angeles Chapter, Second Wednesday of the Month, Jonathan Club, Los Angeles, Calif. Secretary W. A. Wilson.

Tulsa Chapter, Third Friday, "After Five" Room, Hotel Tulsa. Secretary R. E. Kirberger, Unit Rig Manufacturing Company, Tulsa, Oklahoma.

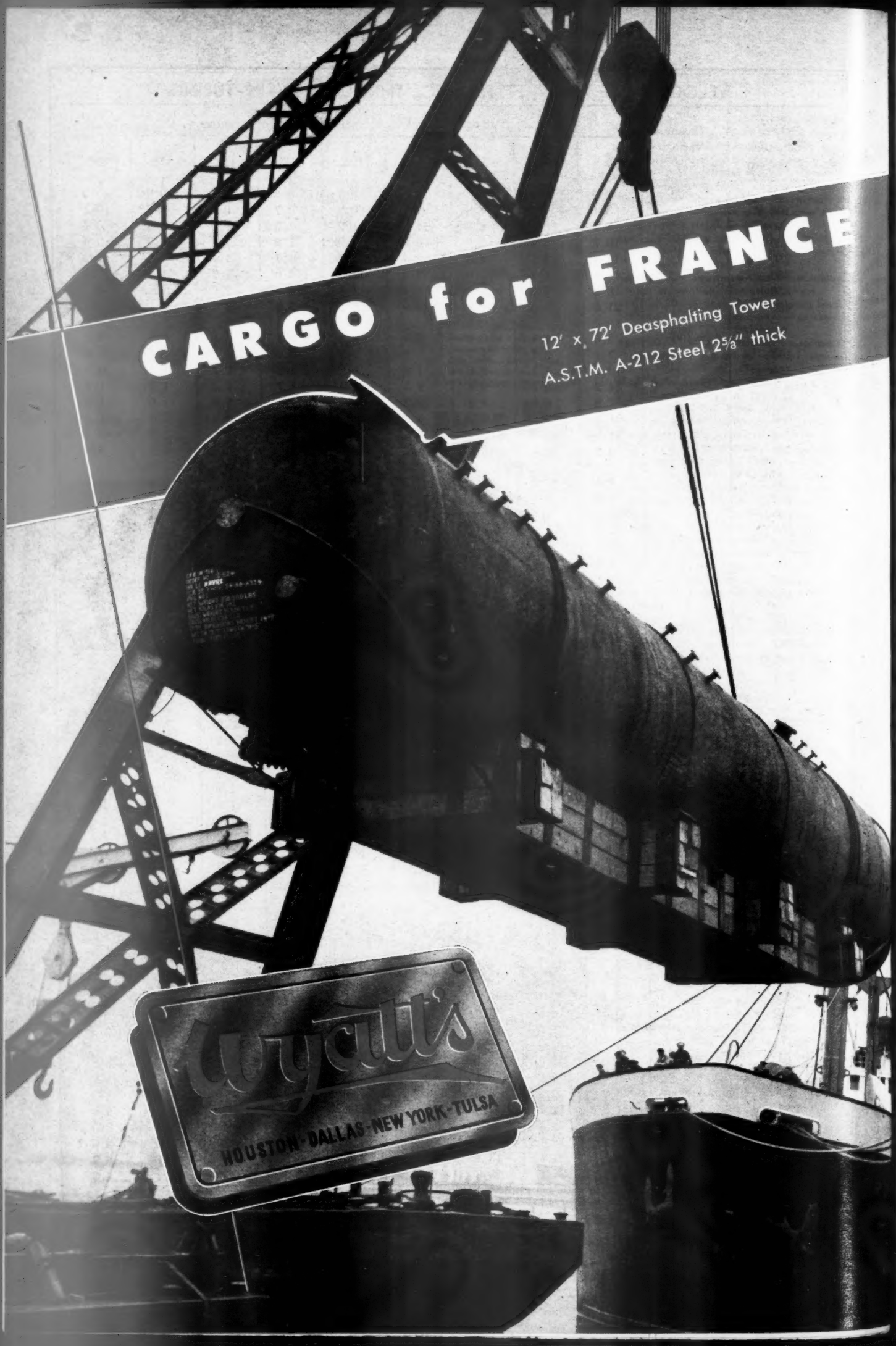
Dallas-Fort Worth Chapter, Dallas, Texas. First Monday of the Month. Secretary Gene Shiels, 205 Irwin-Keasler Building, Dallas, Texas. RI-4042.

VELOCITY[1] OF FLOW, FT. PER SEC., THROUGH 3½-IN. TUBING

Rate of production, bbl. per day	Gas-oil ratio, cu. ft. per bbl.	Tubing pressure[2] at casinghead, lb. per sq. in. gauge								
		0	25	50	75	100	125	150	175	200
50	300	2.7	1.0	0.7	0.5	0.4	0.3	0.3	0.3	0.2
100		5.4	2.1	1.3	1.0	0.8	0.7	0.6	0.5	0.5
150		8.0	3.1	2.0	1.5	1.2	1.0	0.9	0.8	0.7
200		10.7	4.1	2.6	2.0	1.6	1.3	1.2	1.0	0.9
250		13.4	5.2	3.3	2.4	2.0	1.7	1.4	1.3	1.2
300		16.1	6.2	3.9	2.9	2.4	2.0	1.7	1.5	1.4
350		18.8	7.3	4.6	3.4	2.8	2.3	2.0	1.8	1.6
400		21.5	8.3	5.3	3.9	3.1	2.6	2.3	2.1	1.9
50	400	3.6	1.4	0.9	0.6	0.5	0.4	0.4	0.3	0.3
100		7.1	2.7	1.7	1.3	1.0	0.9	0.7	0.7	0.6
150		10.7	4.1	2.6	1.9	1.5	1.3	1.1	1.0	0.9
200		14.2	5.5	3.4	2.5	2.0	1.7	1.5	1.3	1.2
250		17.8	6.8	4.3	3.2	2.5	2.1	1.8	1.6	1.5
300		21.4	8.2	5.2	3.8	3.0	2.6	2.2	2.0	1.8
350		24.9	9.6	6.0	4.4	3.5	3.0	2.6	2.3	2.1
400		28.5	10.9	6.9	5.1	4.1	3.4	3.0	2.6	2.4
50	500	4.4	1.7	1.1	0.8	0.6	0.5	0.4	0.4	0.4
100		8.9	3.4	2.1	1.6	1.2	1.0	0.9	0.8	0.7
150		13.3	5.1	3.2	2.3	1.9	1.6	1.3	1.2	1.1
200		17.8	6.8	4.3	3.1	2.5	2.1	1.8	1.6	1.4
250		22.2	8.5	5.3	3.9	3.1	2.6	2.2	2.0	1.8
300		26.6	10.2	6.4	4.7	3.7	3.1	2.7	2.4	2.1
350		31.1	11.9	7.4	5.5	4.4	3.6	3.1	2.8	2.5
400		35.5	13.6	8.5	6.2	5.0	4.2	3.6	3.2	2.8
50	600	5.3	2.0	1.3	0.9	0.7	0.6	0.5	0.5	0.4
100		10.6	4.1	2.5	1.9	1.5	1.2	1.1	0.9	0.8
150		16.0	6.1	3.8	2.8	2.2	1.8	1.6	1.4	1.3
200		21.3	8.1	5.1	3.7	2.9	2.5	2.1	1.9	1.7
250		26.6	10.1	6.3	4.6	3.7	3.1	2.6	2.3	2.1
300		31.9	12.2	7.6	5.6	4.4	3.7	3.2	2.8	2.5
350		37.2	14.2	8.9	6.5	5.2	4.3	3.7	3.3	2.9
400		42.5	16.2	10.1	7.4	5.9	4.9	4.2	3.7	3.3
50	700	6.2	2.4	1.5	1.1	0.9	0.7	0.6	0.5	0.5
100		12.4	4.7	2.9	2.1	1.7	1.4	1.2	1.1	1.0
150		18.6	7.1	4.4	3.2	2.6	2.1	1.8	1.6	1.4
200		24.8	9.4	5.9	4.3	3.4	2.8	2.4	2.1	1.9
250		31.0	11.8	7.3	5.4	4.3	3.5	3.0	2.7	2.4
300		37.2	14.1	8.8	6.4	5.1	4.2	3.6	3.2	2.9
350		43.4	16.5	10.3	7.5	6.0	5.0	4.3	3.7	3.3
400		49.6	18.8	11.7	8.6	6.8	5.7	4.9	4.3	3.8
50	800	7.1	2.7	1.7	1.2	1.0	0.8	0.7	0.6	0.5
100		14.1	5.4	3.3	2.4	1.9	1.6	1.4	1.2	1.1
150		21.2	8.0	5.0	3.7	2.9	2.4	2.1	1.8	1.6
200		28.3	10.7	6.7	4.9	3.9	3.2	2.8	2.4	2.2
250		35.4	13.4	8.4	6.1	4.8	4.0	3.4	3.0	2.7
300		42.4	16.1	10.0	7.3	5.8	4.8	4.1	3.6	3.2
350		49.5	18.8	11.7	8.5	6.8	5.6	4.8	4.2	3.8
400		56.6	21.5	13.4	9.8	7.7	6.4	5.5	4.8	4.3
50	900	8.0	3.0	1.9	1.4	1.1	0.9	0.8	0.7	0.6
100		15.9	6.0	3.7	2.7	2.2	1.8	1.5	1.3	1.2
150		23.9	9.0	5.6	4.1	3.2	2.7	2.3	2.0	1.8
200		31.8	12.1	7.5	5.5	4.3	3.6	3.1	2.7	2.4
250		39.8	15.1	9.4	6.8	5.4	4.5	3.8	3.4	3.0
300		47.7	18.1	11.2	8.2	6.5	5.4	4.6	4.0	3.6
350		55.7	21.1	13.1	9.6	7.6	6.3	5.4	4.7	4.2
400		63.6	24.1	15.0	10.9	8.6	7.2	6.1	5.4	4.8

[1] Solution of gas and condensation under pressure are not considered; hence the values are maxima.
[2] Gas volumes entering into the velocity calculations are based on tubinghead pressure; atmospheric pressure is assumed to be 15 lb. per sq. in. in calculating the no. of atmospheres.

From The Petroleum Data Book, Second Edition, which carries 750 pages of information on the petroleum industry.


CARGO for FRANCE
12′ x 72′ Deasphalting Tower
A.S.T.M. A-212 Steel 2⅝″ thick
Lummus
HOUSTON · DALLAS · NEW YORK · TULSA

DATA ON IMPORTANT OIL FIELDS OF THE UNITED STATES

No.	Year discovered	Field	County	Producing formation	Gravity °API	Productive acres	Estimated average thickness (feet)
				NEW MEXICO (Contd.)			
6	1930	Eunice, South	Lea	Seven Rivers; Per	33.0	3,640	70
7	1928	Eunice	Lea	Seven Rivers; Per	31.0	1,120	51
8	1929	Grayburg-Jackson	Eddy	Queen, Seven Rivers, Grayburg, San Andres; Per	36.0	11,080	40
9	1928	Hobbs	Lea	San Andres; Per	34.5	10,240	100
10	1922	Hogback	San Juan	Dakota Sd; Cre U	60.0	160	9
11	1935	Langlie-Mattix	Lea	Yates, Seven Rivers; Per	38.0	12,800	20
12	1939	Loco Hills	Eddy	Grayburg; Per	36.0	8,820	20
13	1938	Lovington	Lea	San Andres; Per	33.0	2,040	50
14	1929	Lynch	Lea	Yates, Seven Rivers; Per	30.0	360	17
15	1926	Maljamar	Lea	Grayburg, Queen, San Andres; Per	38.0	9,360	50
16	1936	Penrose-Skelly	Lea	Grayburg; Per	35.0	14,480	90
17	1929	Rhodes	Lea	Seven Rivers; Per	35.0	1,720	25
18	1941	Square Lake	Eddy	Grayburg; Per	37.8	7,480	25
19	1929	Vacuum	Lea	Grayburg, San Andres; Per	35.5	14,560	75
				OKLAHOMA			
		Central					
1	1924	Chandler	Lincoln	Various; Pen, Ord	38.0	1,255	—
2	1904	Cleveland	Pawnee	Various; Pen, Ord, Cam	36.0	4,255	—
3	1938	Coyle	Payne	Hunton, Wilcox; Sil, Ord	46.0	1,338	—
4	1924	Davenport	Lincoln	Various, Pen	43.0	2,570	50
5	1914	Ingalls	Payne	Various; Pen, Miss, Ord	39.0	1,110	—
6	1916	Jennings	Pawnee	Various; Pen, Miss, Ord	37.0	1,375	—
7	1915	Lauderdale	Pawnee	Various; Pen, Ord, Cam	37.0	4,300	—
8	1938	Ramsey	Payne	1st Wilcox, Hunton	42.0	630	27
9	1923	Stroud	Lincoln	Pen, Ord	41.0	590	50
10	1942	Watchhorn, East	Pawnee	Wilcox; Ord	43.0	820	15
11	1914	Yale-Quay	Payne	Oswego, Bartlesville, Wilcox; Pen, Ord	38.0	4,095	—
		East Central					
12	1908	Bald Hill	Okmulgee	Glenn; Pen	30.0	25,095	—
13	1906	Bird Creek	Tulsa	Bartlesville, Wilcox; Pen, Ord	31.0	17,910	—
14	1906	Bowden	Creek	Taneha; Pen	32.0	3,495	—
15	1916	Bristow	Creek	Layton, Ft. Scott, Oswego, Red Fork, Bartlesville; Pen. Dutcher; Miss. Wilcox; Ord	35.0	5,255	—
16	1912	Cushing	Creek	Layton, Jones, Skinner, Red Fork, Bartlesville; Miss	39.0	24,940	—
17	1915	Depew	Creek	Glenn, Dutcher, Wilcox; Pen, Ord	32.0	1,365	—
18	1905	Glenn Pool	Creek	Bartlesville, et al	34.0	15,970	—
19	1901	Jenks	Tulsa	Various; Ord, Cam, Pen, Miss	36.0	6,885	—
20	1907	Morris	Okmulgee	Various; Pen, Miss, Ord	36.0	7,300	—
21	1906	Okmulgee	Creek	Various; Pen, Miss, Ord	30.0	5,020	—
22	1913	Slick	Creek	Various; Pen, Miss, Ord	32.0	6,585	—
23	1943	Stroud, S. E	Creek	Prue; Pen	44.0	2,000	80
24	1914	Turley	Tulsa	Bartlesville, Burgess	32.0	3,750	—
25	1913	Weleetka	Okfuskee	Gilcrease; Pen	39.0	1,815	130
26	1919	Wilcox	Creek	Various; Pen, Ord	35.0	1,375	—
		Northern Area					
27	1935	Billings (Deep)	Noble	Wilcox	41.0	830	—
28	1918	Blackwell	Kay	Various; Pen, Ord	40.0	1,750	—
29	1924	Braman, North	Kay	Various; Pen, Ord	41.0	795	—
30	1933	Crescent	Logan	Layton, Wilcox, Cromwell	41.0	2,520	—
31	1917	Dilworth	Kay	Blackwell, Wilcox; Pen, Ord	40.0	2,350	—
32	1916	Garber	Garfield	Various; Per, Pen, Ord	41.0	4,520	—
33	1941	Guthrie	Logan	Bartlesville, 2nd Wilcox	40.0	620	12
34	1924	Hubbard	Kay	Various; Pen, Ord	37.0	645	—
35	1944	Lovell, S. E	Logan	Layton; Pen	40.0	200	26
36	1932	Lucien	Noble	Wilcox, Viola	42.0	4,170	—
37	1927	Marshall	Logan	Tonkawa, Wilcox, Simpson; Pen	41.0	740	—
38	1930	Otoe City	Noble	Layton, Wilcox; Pen, Ord	39.0	241	30
39	1943	Otoe City, East	Noble	Konhawa, Perry, Layton; Pen	—	590	188
40	1934	Polo	Noble	Various; Pen, Ord	41.0	510	—
41	1917	Ponca City	Kay	Various; Pen, Miss, Ord	38.0	1,445	—
42	1914	Thomas	Kay	Various; Per, Pen, Ord	41.0	275	—
43	1921	Tonkawa	Kay	Endicutt, Tonkawa, Wilcox	42.0	3,695	—
		Oklahoma City					
44	1936	Britton	Oklahoma	Simpson, 2nd Wilcox; Ord	45.0	1,245	—
45	1930	Edmond	Oklahoma	Simpson, Wilcox; Ord	39.0	1,000	—
46	1941	Edmond, N. E	Oklahoma	Redfork; Pen	38.0	640	5
47	1943	Edmond, West	Oklahoma	Hunton; Dev	41.0	31,400	18

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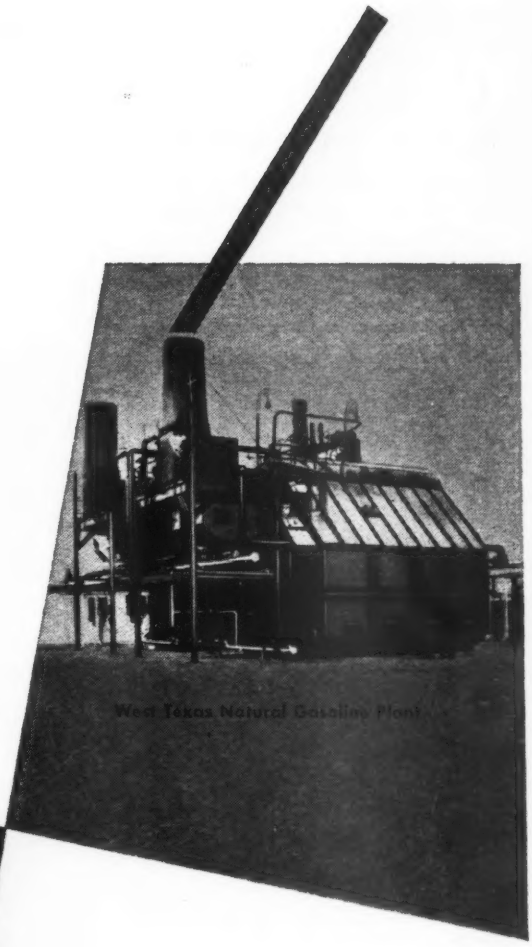
DATA ON IMPORTANT OIL FIELDS OF THE UNITED STATES

No.	Annual production (thousands of barrels)						Cumulative production thru 1947 (M bbl)	Estimated recovery per acre (bbl)	Number wells producing		
	1942	1943	1944	1945	1946	1947			Total	Flowing	Pumping
							NEW MEXICO (Contd.)				
6	667	925	788	587	553	574	9,290	2,395	—	—	—
7	157	313	367	395	366	431	2,386	1,746	—	—	—
8	1,510	1,916	1,979	2,024	1,811	1,942	20,088	1,638	—	—	—
9	2,973	3,978	4,101	3,801	3,570	3,544	119,751	11,347	—	—	—
10	64	45	66	81	87	—	—	15,313	—	—	—
11	1,907	1,654	1,405	1,331	1,194	1,120	22,760	1,691	—	—	—
12	1,594	1,286	1,117	987	965	878	11,751	1,232	—	—	—
13	452	597	657	593	617	597	4,654	1,989	—	—	—
14	92	130	119	105	101	—	—	20,561	—	—	—
15	1,664	1,740	1,830	2,065	1,976	2,121	15,475	1,426	—	—	—
16	806	612	504	815	741	613	17,730	1,182	—	—	
17	121	184	297	370	358	—	—	1,740	—	—	—
18	348	1,031	1,135	1,001	842	641	5,005	583	—	—	—
19	3,296	4,947	5,010	4,502	4,062	4,107	39,171	2,408	—	—	—
							OKLAHOMA				
			Central								
1	209	205	246	210	204	271	13,264	10,353	60	0	60
2	144	141	132	126	122	131	40,948	9,593	168	0	168
3	1,661	1,614	1,216	988	711	482	9,191	6,509	—	—	—
4	161	159	154	276	451	258	13,427	5,124	137	0	137
5	113	106	91	86	80	69	6,649	5,928	24	0	24
6	67	58	53	48	45	43	4,286	3,086	39	0	39
7	213	182	182	192	215	203	14,577	3,343	147	0	147
8	1,665	1,586	1,244	989	797	836	12,041	17,786	—	—	—
9	158	156	160	297	341	266	10,287	16,985	40	0	40
10	431	1,025	887	842	817	793	4,795	4,880	28	0	28
11	566	584	587	596	675	772	25,888	6,133	—	—	—
			East Central								
12	365	318	293	266	253	245	50,945 Ⓔ	2,020	594	0	594
13	409	342	327	306	285	280	72,180 Ⓔ	4,015	1,207	0	1,207
14	124	117	110	104	105	106	21,556 Ⓔ	6,137	214	0	214
15	303	279	283	270	259	233	39,133 Ⓔ	7,402	111	0	111
16	3,068	2,989	2,925	2,820	2,784	2,838	376,784	14,994	—	—	—
17	381	341	326	305	330	294	38,344	27,875	70	0	70
18	1,481	1,739	2,134	2,356	2,887	2,571	233,762	14,447	—	—	—
19	84	76	71	76	76	77	26,982 Ⓔ	3,908	273	0	273
20	123	104	94	99	91	87	25,517 Ⓔ	3,484	175	0	175
21	54	57	56	52	45	46	10,551 Ⓔ	2,093	139	0	139
22	467	430	393	372	559	446	36,096 Ⓔ	5,414	—	—	—
23	0	141	563	867	410	238	2,219	991	87	0	87
24	81	70	79	76	75	69	6,239 Ⓔ	1,645	288	0	288
25	207	168	142	130	118	111	6,871 Ⓔ	3,725	73	0	73
26	174	156	134	135	128	117	4,665 Ⓔ	3,308	50	0	50
			Northern Area								
27	2,062	1,690	1,491	1,290	807	538	19,146	22,419	72	0	72
28	146	132	121	115	129	131	5,926	3,311	35	0	35
29	209	187	181	174	156	134	19,281	24,084	42	0	42
30	734	761	1,206	1,868	1,569	1,324	20,932	7,781	—	—	—
31	283	249	217	192	221	248	6,680	2,737	70	0	70
32	611	601	612	598	652	512	58,733	12,881	—	—	—
33	1,151	638	323	210	115	92	3,307	5,185	21	0	21
34	137	135	127	123	132	129	9,168	14,014	34	0	34
35	0	0	16	185	513	505	1,212	3,575	—	—	—
36	1,478	1,251	1,136	983	799	700	34,771	8,171	—	—	—
37	49	53	47	45	52	53	12,076	16,247	20	0	20
38	74	135	132	118	127	101	831	3,029	13	0	13
39	0	29	232	172	123	85	641	942	15	0	15
40	240	167	154	160	405	248	5,465	10,229	26	0	26
41	86	77	70	66	58	54	6,823	4,684	39	0	39
42	76	71	71	70	77	74	7,630	27,476	14	0	14
43	594	504	408	394	434	375	124,077	33,478	—	—	—
			Oklahoma City								
44	103	90	92	86	74	64	2,933	2,304	20	—	—
45	1,053	941	770	648	761	552	22,750	22,198	—	—	—
46	91	212	274	241	276	239	1,354	1,742	23	—	—
47	0	474	7,731	26,775	23,500	14,671	73,151	1,862	781	—	—

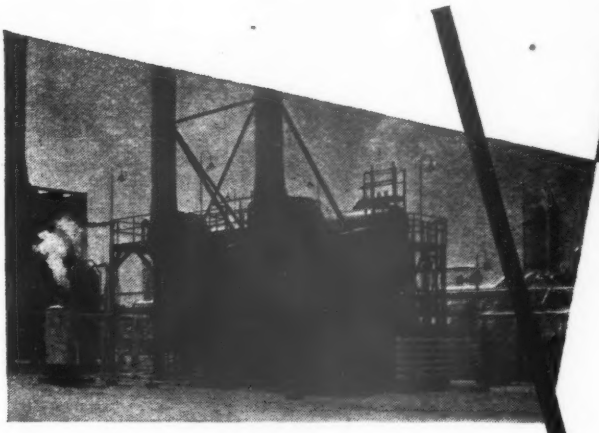
From The Petroleum Data Book, Second Edition, which carries 750 pages of information on the petroleum industry.

WICKES

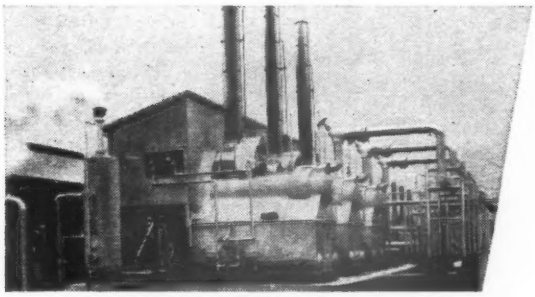
STEAM GENERATORS speed processing and cut costs in refineries and natural gasoline plants



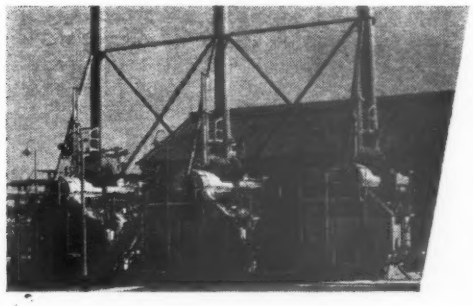
West Texas Natural Gasoline Plant



Central Texas Natural Gasoline Plant



▲ Louisiana Refinery



▼ Indiana Installation

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136

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LETTERS *to the* EDITORS

Permeability Study

To The Petroleum Engineer:

I wish to call attention of petroleum technologists, particularly petroleum geologists and petroleum engineers, to a recent paper by Ernest L. Ohle, "The Influence of Permeability on Ore Distribution in Limestone and Dolomite," *Economic Geology*, November, 1951, Vol. 46, No. 7, pp. 667 to 706 (Part 1) with Part 2 scheduled for December. (Editor's note: Mr. Travis wrote later that Part 2 is even more interesting than Part 1.)

In spite of the application to ores, in my opinion, the Ohle contribution on permeability represents one of the great fundamental steps in our further knowledge of permeability, particularly in carbonate rocks (limestones and dolomites) of oil and gas reservoir possibilities.

I regard his observations on "flow between parallel plates" as opening a fresh wedge in our thinking hitherto too much confined to spherical shapes. Let Ohle explain, as follows: (p. 671)

"Because the greatest volumes of fluid in intergranular motion (chiefly ground water and petroleum) move through sandstone or unconsolidated clastic sediments and because of the economic significance of these fluids, practically all of the experimental work on permeability has used sandstones or olusters of spheres as the porous medium. Relatively little work has been done on chemically precipitated rocks...."

(p. 673) (referring to recrystallized limestones)

"... The continuity and shape of the channelways along with their size and abundance are determining factors in rock permeability ... Coarsening of the grain greatly reduces the number of pores but the newly created interstices are larger and in addition they are much straighter and smoother, and longer from offset to offset. The routes presented to transmitted fluids by such recrystallized rocks are far less devious than those available in the original fine grained limestone. Since the coarse grains tend to have plane boundaries, the flow is essentially between parallel walls ... For both laminar and turbulent flow, the flow between parallel plates (i.e., a rectangle) gives the greatest flow per area...."

Maury M. Travis.
Federal Power Commission,
Washington, D. C.

"Spoof" Pleases

To The Petroleum Engineer:

I would appreciate receiving six copies of the article appearing on page A-58 of the January issue of *The Petroleum Engineer* written by Ernestine Adams entitled "The Multi-Billion Dollar Spoof."

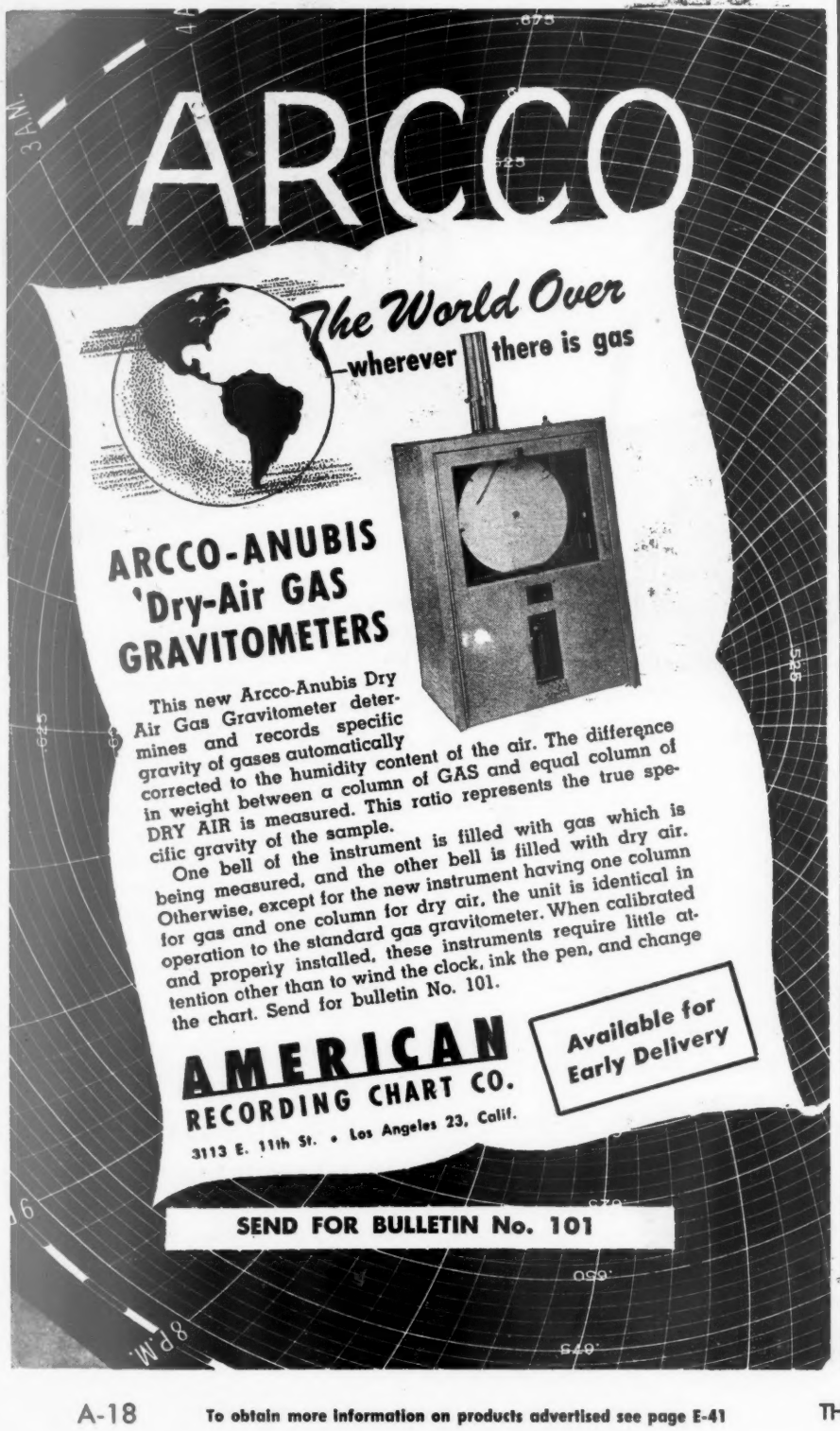
You are to be commended on giving so much space to such a timely article, especially for the benefit of those who endeavor to advance any of the democratic systems for which our country is so well noted.

Tilford H. Bean.
Process Engineer,
Austin, Texas.

To The Petroleum Engineer:

My copies of The Petroleum Engineer have been arriving on schedule and I have enjoyed them very much. Wish to extend my congratulations to Ernestine Adams, managing editor, for the excellent article "The Multi-Million Dollar Spoof," which was in the January, 1952, edition.

Yours very truly,
Virgil D. Stone.
Assistant Area Petroleum Engineer,
Gulf Oil Corporation,
Triumph, Louisiana.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To The Petroleum Engineer:

After reading the article entitled, "The Multi-Billion Dollar Spoof" in your January issue, I was impressed by the penetrating and succinct presentation of a matter which should be uppermost in every thinking American's mind. So much impressed that I should like very much to obtain a copy of that single article if at all possible.

It is the writer's opinion that your magazine deserves the highest praise in publishing such forthright material.

Sincerely,

Betty J. Eddy.

240 North Aliso Street,
Ventura, California.

Pipeliner Praise

To The Petroleum Engineer:

I am returning to you herewith the current list for Pure Transportation subscription renewals for 1952.

May I take this opportunity to state that I believe the issues of *The Petroleum Engineer* that have been coming to the key personnel in this division have been well received. I also believe that it has proved to be advantageous to myself and to the company to keep the key personnel in the division aware of the latest developments in pipe lining throughout the country, and the coverage of our industry by your publication has been excellent. I have noted from time to time suggestions from our personnel receiving your magazine which tie in directly with some article or advertisement contained in your issues, and as a consequence I feel that our continued renewal of the subscriptions is warranted.

W. F. Stebbins

Superintendent,
Pure Transportation Company

Reclaimed Pipe Line Boosts Oil Production

Steel for oil-country tubular goods is in such short supply that oil companies go to almost any lengths to find it. Recently a California oil producer dug up a 38-year-old pipe line, over 40 miles long, from the Mojave Desert where it was no longer being used. The lengths of six-inch pipe were trucked 200 miles over 4000-ft mountains. They were straightened, blasted with pellets, and rewelded into 40-ft lengths. With this reclaimed pipe, the company will be able to boost production in one oil field from 2500 bbl a day to 24,000 bbl a day. This is a good example of how resourcefulness and ingenuity can bring results in the oil industry.

☆ ☆ ☆

Gasoline prices, not including taxes, in August of 1951 were nearly a penny a gallon lower than 25 years ago. And 10 gallons of today's gasoline will do as much work as 15 gallons of gasoline 25 years ago.

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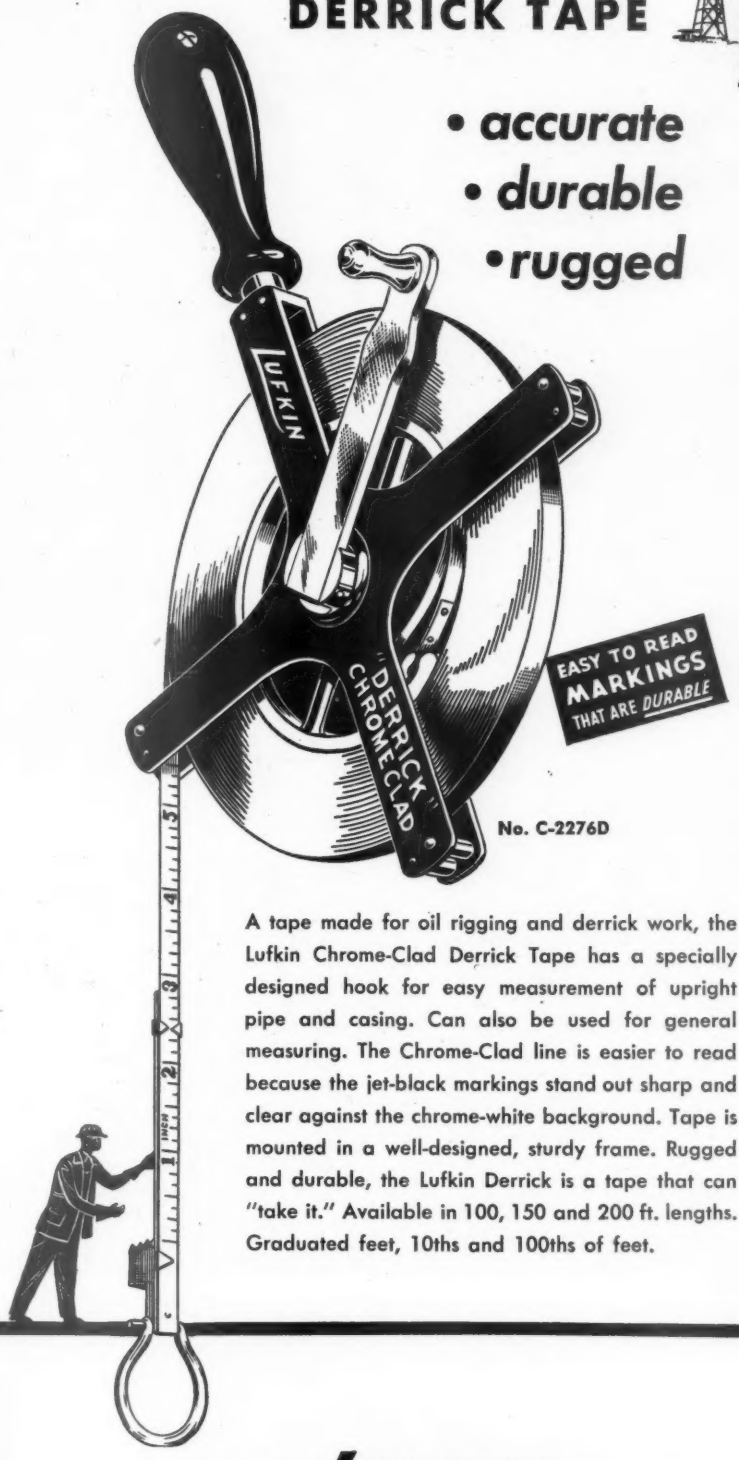

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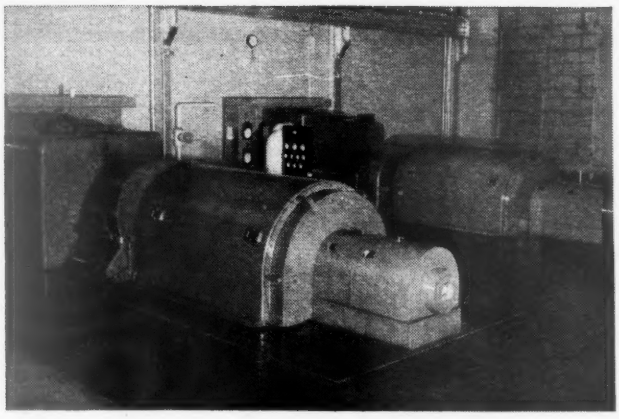
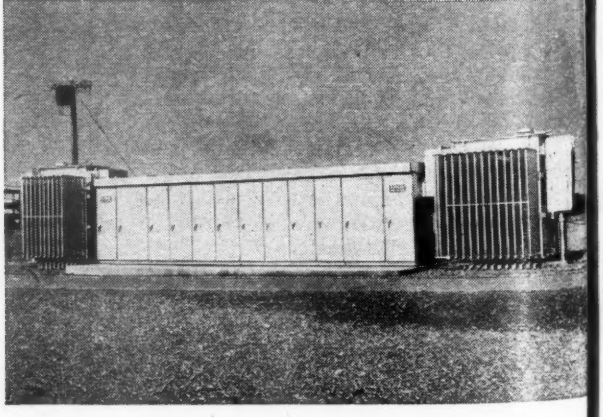


Power is supplied by two Westinghouse Turbine-Generators—plus a stand-by tie-in with utility power. From here, power is sent through *dual feeders* at *high voltage* to substations and load centers throughout the plant.



Each substation is complete with switchgear, transformers and circuit breakers—for redistribution of low voltage power. This method makes the system highly flexible and dependable and improves voltage regulation

THE Petroleum Engineer

March, 1952

Oil and Gas in the Uintah Basin of Utah

When some one says "We are running out of oil," remember the great areas of promise in the United States where exploration has only begun. Each has oil and gas fields and refineries and pipe lines, but as yet only a fraction of its promise has been fulfilled. Presented here is one great potential oil and gas region—the UINTAH BASIN.

DORSEY HAGER

ATTENTION was first drawn to the Uintah Basin of Colorado and Utah by the oil found in the great Rangely field in Colorado, some 12 miles east of the Utah line. The Rangely field is on the northeast margin of the Uintah Basin.

Although considerable early drilling had been done on the Utah side of the Basin, over 13 wells were drilled before any oil production was found. The Utah side of the Basin was not recognized to be of much importance until the late 40's.

In 1949 the Uintah Basin of Utah sprang into prominence as a great potential source of petroleum when the Carter and the Stanolind Oil Companies completed their discovery well, Ute Tribal No. 1 in Green River beds of Eocene age in what is called the Roosevelt oil field, Uintah County. In 1947 the small Ashley Valley field, east of Vernal, Uintah County, had become an oil producer from the Weber sandstone of Permian age although natural gas had been produced for many years in the Uintah Basin from the Dakota sandstone of the Cretaceous period.

The discovery of free oil in the Green River beds of Eocene age (Tertiary) is approximately 11,000 ft higher than the oil found in the Weber beds at Ashley Valley and has opened an entirely different geologic section to oil operations. In 1950 and 1951 two other fields in the Uintah Basin have been added, intensifying activity.

So much interest has been aroused that oil men from all over the United States have come to Utah seeking holdings and an active lease play has taken place.

The Land Situation

Large independents and major oil concerns control nearly all the land in large blocks. Over 70 per cent of the land is Federal land, about 11 per cent is state land, and the balance is Indian land and fee land. Scarcely an acre in the Uintah Basin remains unleased at this time.

Most of the royalty is of the overriding type on Federal and on state lands, which carry 12½ per cent royalty. On Federal lands the maximum overriding royalty allowed is 5 per cent. Over 6,000,000 acres of land are under lease. The Indian lands are put up for competitive bidding.

EXCLUSIVE

Oil Companies in Uintah Basin

Among the oil companies in the Basin are:

California Company, Carter Oil Company, Cities Service Oil Company, Continental Oil Company, General Petroleum Company, Gulf Oil Company, Ohio Oil Company, Phillips Oil Company, Shell Oil Company, Sinclair Oil Company, Stanolind Oil Company, Sun Oil Company, The Texas Company, Union Oil Company of California.

Deep Wells Productions, Inc., Equity Oil Company of Utah, Hollandsworth-Travis, Honolulu Oil Company of California, Husky Oil Company, Roy Johnson, Ardmore, Oklahoma, Mid-Continent Oil Company, Monarch Petroleum Company of Utah, Pacific Western Oil Company, Union Sulphur Company of Texas, Utah Southern Oil Company.

TABLE 1

GEOLOGIC COLUMN FOR UINTAH BASIN, UTAH

	Formation	*Character*	*Approximate thickness*	*Number*	*Possible gas and oil pays*
Oligocene.....	Duchesne River	Clays, sands, shales	1500		
Eocene.....	Uintah	Clays, sands	3000		
	Green River	Shales—ss.—ls.	3000— 4000	3 to 4	Oil at Roosevelt and Gusher, Uintah, County, Utah
	Wasatch	Shale—sandstone	2000	5 to 6	Oil at Duchesne, Duchesne County, Utah
U. Cretaceous...	Mesaverde	Coal beds—shales—sd.	2000	8 to 10	Oil at Willow Creek, Uintah County, Utah
	Mancos	Dark shale—some sands	4000— 5500	2 to 3	
	Frontier	Sandstone	150— 200	1	Gas at Clay Basin, Utah
	Mowry	Shale	100		
	Dakota	Sandstone	50— 100	1	Gas at Ashley Valley, Utah
L. Cretaceous...	Cloverly (Lakota)	Shale—sandstone	150	1 to 2	
Jurassic.....	Morrison	Shale—some sands	500— 800	1 to 2	Gas at Ashley Valley, Uintah County, and Cisco Dome, Grand County
	Curtis	Limey shale—sandstone	250	1	
	Entrada	Sands and shale	180— 400	1	
	Carmel	Marine ls.—shales	150— 300		
	Navajo (Nugget)	Massive sandstone	1000	1	Oil at LaBarge, Wyoming
Triassic.....	Chinle	Ashy shales	400		
	Shinarump	Coarse sandstone	50— 100	1	Oil at Ashley Valley
	Moenkopie	Red mudstones—sands gypsum	500— 800	1	Gas at Last Chance, Emery County; Oil at Virgin, Washington County; Oil at Iron Wash, Emery County
Permian.....	Kaibab—Phosphoria	Limestone	50— 100	1	Oil at Ashley Valley
	Weber	Massive sandstone	1000	1	Oil at Ashley Valley
Pennsylvanian..	Morgan—Hermosa	Shales and limestones	1200— 1400	2 to 3	Gas at Boundry Butte SE Utah
Mississippian...	Black Shale		200	1	
	Madison	Massive limestone	600	1	Oil at Upper Valley, Garfield County, Utah
Cambrian.....	Ladore Quartz				
	Arkosic sand		350— 400	1	
			27,430—30,300	34 to 42	

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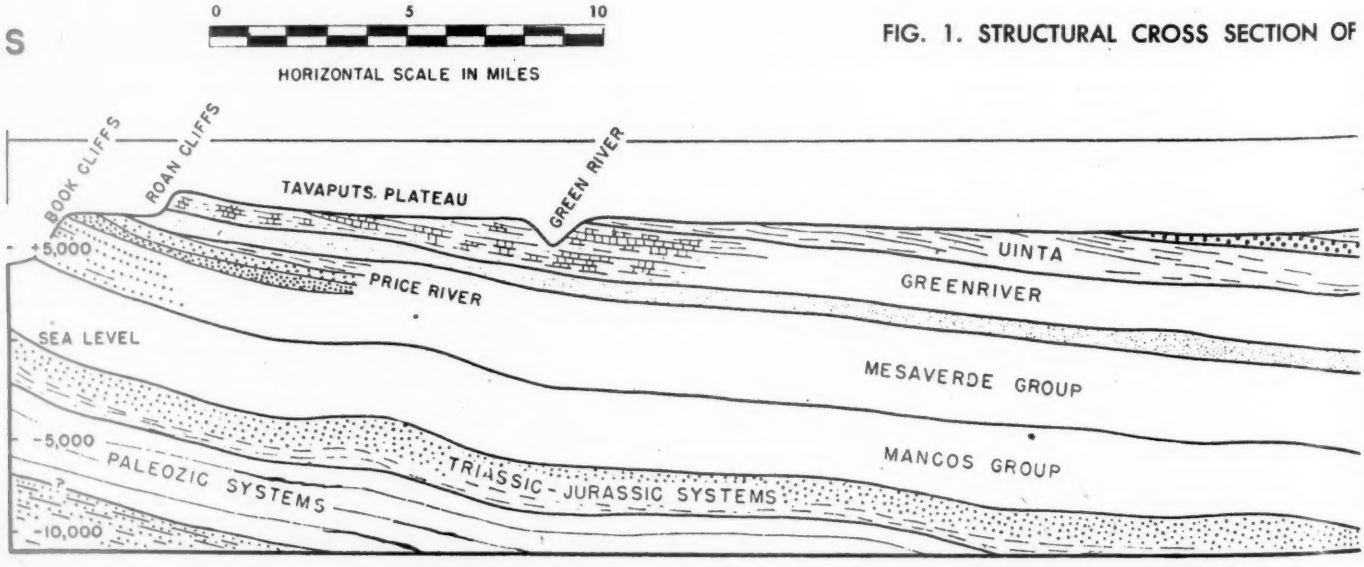


FIG. 1. STRUCTURAL CROSS SECTION OF

Principal Towns in Uintah Basin

Vernal, the largest town in the area with a population of 3000, is a Mormon community with good schools and good churches, with Kiwanis, Lions Club and active Chamber of Commerce, and an aggressive Junior Chamber of Commerce. Although primarily an agricultural community there are other natural resources, and there will be a plentiful supply of water power to generate electricity when Echo Dam is built. This will make this town a very active one regardless of oil developments. It now has an excellent hotel.

Salt Lake City, 190 miles west of Vernal, is the nearest large city and is reached by truck; in fact, all hauling is by truck. Along this line it is interesting that all the brick in the bank at Vernal were hauled in by parcel post. The brick were packaged to meet postal specifications but came in cheaper than by truckload from Salt Lake City. Uncle Sam changed his schedules after that experience.

Roosevelt, population 1700, the next town in size, is developing rapidly due to the oil business and to local agriculture.

Geology

Structural Geology. The Uintah Basin is a geo-synclinal feature lying between the Uintah Mountains on the north, the Uncompaghre Uplift to the southeast, the San Rafael Swell to the south, and the Wasatch Plateau on the west and southwest. The axis of the deepest part of the Basin is shown in Fig. 2.

Minor folds extend northwest from the Uncompaghre Uplift of Colorado into the Uintah Basin and minor folds from the Uintah Mountains also project into the Basin. The Duchesne oil field is on an East-West surface fold faulted on the south. The seismograph fold checks the surface folding. This feature is one of several folds with such trends but the usual direction is northwest.

Stratigraphy. The stratigraphy of the Uintah Basin is summarized in Table 1 and is also clearly shown in the cross-section graphically outlined in Fig. 1. The beds all incline or dip into the Basin from the various uplifts so that in the center 30,000 ft of beds should be encountered before basement is reached.

The Author

Dorsey Hager is a consulting geologist in Salt Lake City, Utah. He is author of numerous technical and scientific articles, including *Oil Field Practice, Fundamentals of the Petroleum Industry, and Practical Oil Geology.* A former student of Washington University, in St. Louis, Missouri and Columbia University, New York City, Hager has worked in the oil fields of California, Texas, Rocky Mountains, Mid-Continent and Canadian areas. He is a member of the American Association of Petroleum Geologists and the American Institute of Mining and Metallurgical Engineers.

Surface Oil Showings

The Uintah Basin is partially crossed by gilsonite veins that extend in a northwest direction. Gilsonite or Uintahite is dried petroleum. The veins are from a few inches to 20 ft in width and have been tested 1000 ft or more in depth. The Standard of California owns the American Gilsonite Company, which produces gilsonite at Bonanza, Uintah County, Utah. Some of the gilsonite produced there is crushed very fine and is injected in proportions of 1 bbl gilsonite to 15 bbl of oil into the pipe line from Rangely to the Utoco plant at Salt Lake City.

Elaterite or wurtzilite, another form of hydrocarbon related to petroleum, is found at several places in the Uintah Basin.

Ozocerite, a natural petroleum wax, is found at Summit, northwest of Castlegate, and has been mined for years.

Around the periphery of the Tertiary beds there are numerous occurrences of asphaltic sands; in fact, few regions are as rich in evidence of oil as the Uintah Basin.

In several coal mines near Castlegate on the southwest rim of the Basin the Mesaverde beds are found oil-saturated and even make a few barrels of oil daily in the coal mines, a nuisance to the miners. The Nugget sandstone is found heavily asphaltic at several places on the south slope of the Uintah Mountains.

Possible Pays

Tests on the eastern edge of the Uintah Basin should reach the Weber sandstone at depths of around 13,000 ft. In drilling to that depth, the holes will start well down in the Green River formation or in the upper Wasatch formation and penetrate the basal Wasatch, the Mesaverde formation, the upper sands of the Mancos shale, the Dakota sandstone, the Morrison sandstone, the Nugget sandstone, and the Weber sandstone. All produce gas or oil in the general area of Colorado, Wyoming, and Utah.

There are 12 possible pays that can be reached on the periphery of the Basin at less than 15,000 ft. Within the Basin, the Green River, Wasatch, and Mesaverde beds are under 15,000 ft in depth and may be prolific "pays." Testing is fully justified. (See Table 1.)

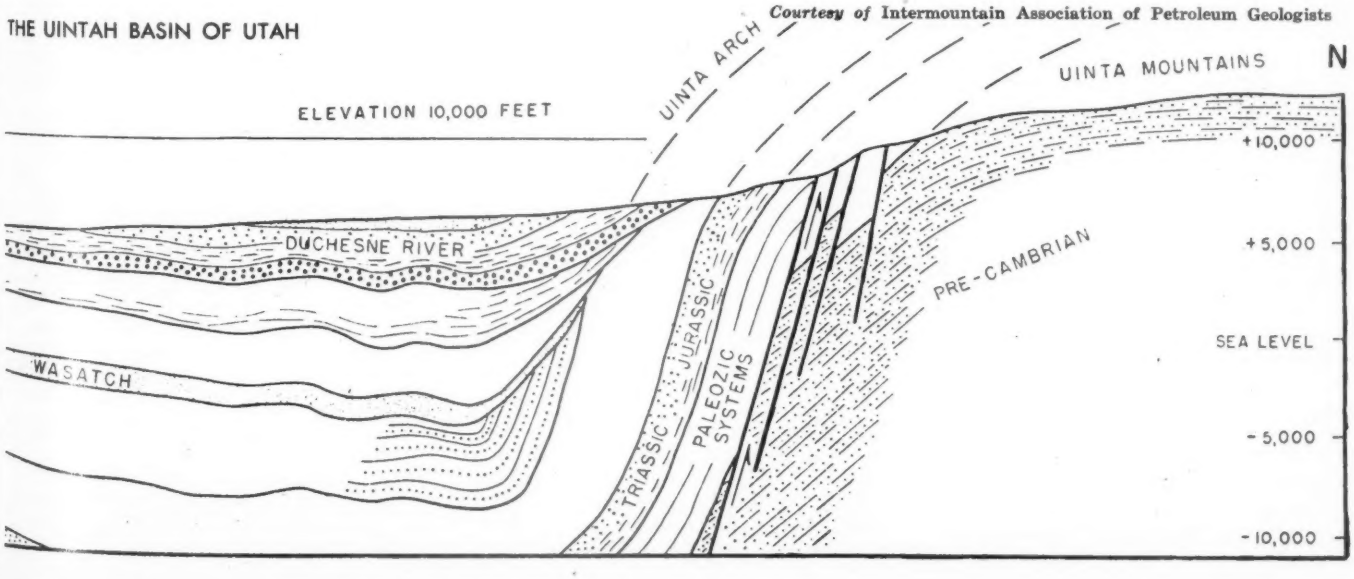
Oil Found in Joint Planes

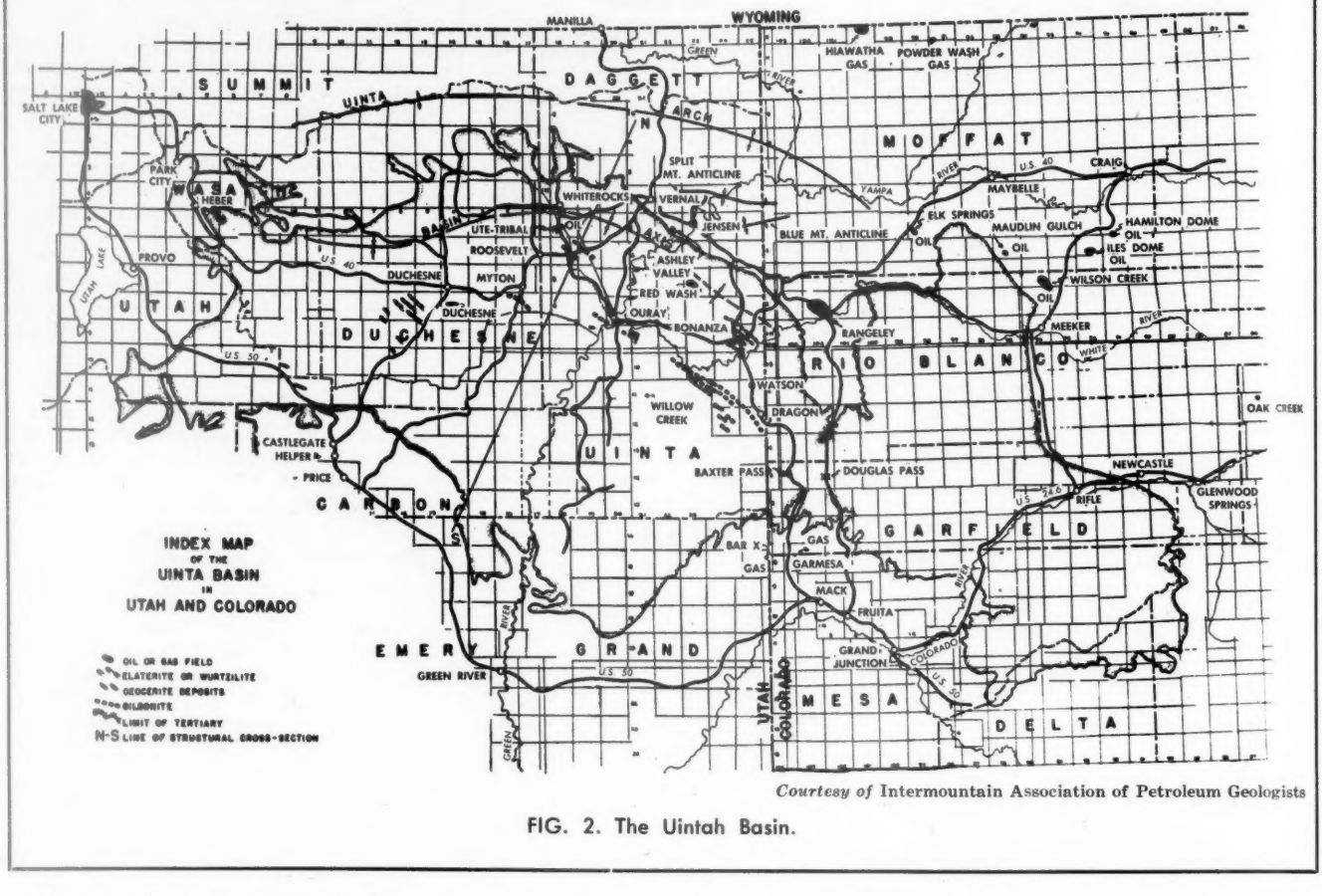
Oil occurs in the Roosevelt field in fractures and in joint planes in the Green River shales, and at Red Wash and at Duchesne in sands in the Green River and in the Wasatch beds.

The production in the Green River shales in the Carter-Stanolind wells, Ute Tribal No. 1 and No. 2, and in Phillips' Leeton well in the Roosevelt field comes largely from vertically frac-

THE UINTAH BASIN OF UTAH

Courtesy of Intermountain Association of Petroleum Geologists





Courtesy of Intermountain Association of Petroleum Geologists

FIG. 2. The Uintah Basin.

tured and jointed shales as the shales are finely laminated and brittle in character. In completing the wells Hydrafrac is used to widen the fractures. The shales are sometimes limey and respond to acid, which is used in large volume.

The California Oil Company's production at Red Wash comes from lenticular sands in the basal Green River beds. In the Duchesne field the Carter Oil Company's production comes from Wasatch sands lying just below the Green River formation although some Green River oil was found at the shallow depth of 3500 ft, a pay that may be produced.

Oil Shales

The Green River formation of Eocene age is not only productive of petroleum but carries vast deposits of oil shales that may one day supply our national needs for oil. These shales carry organic material that on distillation yield oil but even the richest oil-shales do not carry free oil.

Origin of the Uintah Basin Oil

There are two schools of thought regarding the origin of the petroleum. One holds that the oil comes from source beds below the oil-producing Green River and Wasatch beds, which are both of Eocene age. Such lower beds are the Mesaverde and Mancos formations of Cretaceous age. The marine Mancos and lower shales contain the Frontier sands, which are productive in the states of Colorado and Wyoming and produce gas at Clay Basin and at Clear Creek, Utah.

On the other hand the free oil in the Green River and in the Wasatch beds could well be indigenous to such formations. In my opinion the oil-shale beds carrying kerogen are not the source beds but much of the rich organic material that was buried in the brackish water lake beds is the source of the oil. Some of the material was transformed into petroleum, in other instances the material was buried in the shales to become oil-shale. Differences in the source material and the action of organic and chemical agencies determined whether petroleum was formed or whether oil-shale resulted. There are plentiful fossil remains of fish life, algal, and other forms of life to have supplied source material, and whether the resulting product was petroleum or oil-shale depended upon environmental conditions as well as upon the nature of the source material.

Range of Production

Roosevelt Oil Field. The Roosevelt oil field is on a large seimograph nose. Production in the Carter-Stanolind Ute Tribal No. 1 and No. 2 wells is from 9100 to 9350 ft. In the new Phillips' Leeton No. 1, two miles west of Ute Tribal No. 1, the depth of the pay is from 9700 to 9850 ft or approximately 500 ft deeper with no water in the pay. The Blue Bell hole, 12 miles west of the Ute Tribal No. 1, was not a producer but had considerable oil. Although over 2000 ft deeper than Ute Tribal No. 1, the Green River shales did not carry water. It is dangerous, perhaps, to generalize from such scanty data, but the facts so far point to the conclusion that production will be found far down the dip of the Roosevelt fold wherever porosity is present in the Green River shale.

Duchesne Field. The Duchesne field is both a surface and a seismograph feature. A fault cuts the south side of the fold. The structure trends East to West. Only two wells have been completed to date so that productive limits cannot be defined. The field was discovered and is operated by Carter.

The principal pay at a depth of 7550-7700 ft occurs in a Wasatch sand underlying the Green River beds. Other sands in the Wasatch and in the underlying Mesaverde beds are quite likely. It is possible here to penetrate the Mesaverde beds under 10,000 ft. In line with oil showings at Willow Creek in the Mesaverde beds and the natural gas in the Mesaverde at West Douglas Creek, good possibilities exist that the Duchesne fold may have several good pays. A shallow Green River pay was encountered at 3500 ft but it may not be produced as it is a very heavy tarry oil.

Red Wash Field. The Red Wash field of the California Company is producing from sands. Production is governed by a dying out of this sand eastward. Here the Green River section carries basal sands and it is these instead of the shales that prove productive.

TABLE 2. PRODUCING FIELDS IN UINTAH BASIN OF UTAH

This list of producing fields is shown as of December 31, 1951

Field	County	"Pays"	Ages	Date of discovery	Depths	No. wells producing	No. wells drilling	Daily producing capacity	* Cumulative to 1/1/51. (covers period 1948 thru 1950.)	1951	Total to 1/1/52
Ashley Valley	Uintah	Dakota -gas	Cretaceous	1925	—	—	—	—	1,546,908	983,234	2,530,143
		Phosphoria -oil	Permian	1950	3800	2	0	—			
		Weber -oil	Permian	1948	4000	30	0	—			
Duchesne	Duchesne	Gr. River Shale	Eocene	1951	3500	2	2	3000	—	29,064	29,064
		Wasatch Sand	Eocene		7500	—	—	800			
Roosevelt	Uintah	Gr. River Shale	Eocene	1949	9100—9700	3	3	4000	300,568	218,072	518,641
Red Wash	Uintah	Gr. River Shale	Eocene	1950	5500	5	8	3000	—	86,898	86,898
West Douglas Creek	Uintah	Mesaverde-gas	Cretaceous	1950	—	2	0	—			
Willow Creek (good oil showing)	Uintah	Mesaverde -oil	Cretaceous	1951	—	1?	1	—			
									1,847,477	1,317,269	3,164,747

Note: Oil runs are far under the rated capacities as transportation is still all by truck.

Water is a problem in completion here. Although water is not in the pays, it is found between them and must be squeezed off.

The oil occurs at depths of 5500 to 5800 ft. The beds dip northwest at a rate of 1½ to 2 deg, however, and production deepens with the dips. The extent of the field is still unknown.

Five wells have already been drilled. The wells rate from 50 to 500 bbl. They are choked and allowed to produce only 370 bbl daily for the field. All holes are drilled and completed with rotary.

Willow Creek Prospect. The most recent and one of the most important finds was made at Willow Creek in Uintah County by the Carter Oil Company. The test is not yet a well, but at 8176 ft free oil was found in the Mesaverde sandstone of the Cretaceous period. Previously Johnson and Bunn had opened a gas field in the Mesaverde sandstone on the West Douglas Creek structure, a faulted nose in the Uintah Basin, just across the Utah line, but several additional holes nearby were dry.

Mesaverde production on the south side of the Basin and also along its north rim is almost assured, however, by this new strike at Willow Creek when additional tests are made. It is possible to reach this pay in the Roosevelt area at less than 14,000 ft in depth.

Getting the Oil to Market

At present the oil is being transported from the Roosevelt and Duchesne fields by huge trucks carrying 5000 gal per load. Transportation costs for the 160-mile trip from Roosevelt are high for the small volume of oil transported, but pipe lines will later handle these oils. The oil from the Red Wash and the Ashley Valley fields is trucked to the pipe line at Rangely.

One pipe line extends through the area from Rangely, Colorado, to Salt Lake City. This line does not yet handle oil from any of the new fields, as the high pour points of the oils make it impracticable to handle such oils without heating, but sooner or later pipe line connections will be made or new lines will be built.

The Uintah Basin oils range from 85 to 100 F pour point; in other words, they gel at such temperatures. It is interesting in a summer day at 90 deg temperature to see a wax-like jelly on the valves at the wells and in the pits near where the wells are blown off.

Dewaxing plants are on the planning boards, but as yet none have been built. De-waxed oils can be readily handled through a pipe line.

Prices for Oil

The scale of prices for the Uintah Basin are as follows:

Prices for oil		
Ashley Valley	31 to 32 API	$2.28 per bbl gross
Roosevelt field	32.6	1.90 per bbl net
Duchesne	44	2.19 per bbl net
Red Wash	40	2.65 per bbl gross

Drilling Operations

Rotary tools are employed almost exclusively in drilling Uintah Basin holes. The first holes in the new areas core a great deal using diamond-core drills. Mud wagons are kept at the wells and drill stem testing is used freely.

Where oil is found in the Green River shales, it occurs in the fractured shale. The fractures are mainly vertical, and every effort is made to carefully determine the fractured intervals as only parts of the total shale body are fractured. Mud losses are considerable. Mud accounts for 10 to 20 per cent of the total cost of a well. Well costs are higher now than will be the case later—wells at Roosevelt cost $300,000 to $400,000—at Duchesne, $250,000, and at Red Wash, $180,000.

Completion Methods

Holes in the Roosevelt field usually are started with 16 to 13¾ conductor to 200 ft, 10¾ hole to 600-1000 ft, and 7 in. casing is usually set above the productive zones that are first cored and drill stem tested. Most holes are completed with oil-based mud used with rotary drilling. At Red Wash 7 in. pipe is set through the productive section in some holes and the casing is gun perforated—5 to 6 perforations per foot.

Refining Capacity

The present refining capacity of Salt Lake City is around 60,000 bbl daily for 1950 but this is being increased to 75,000 bbl. As production increases, new capacity will be added.

Most of this oil is transported to Salt Lake City by pipe line from Rangely, Colorado, and from Wyoming.

Refining Capacity

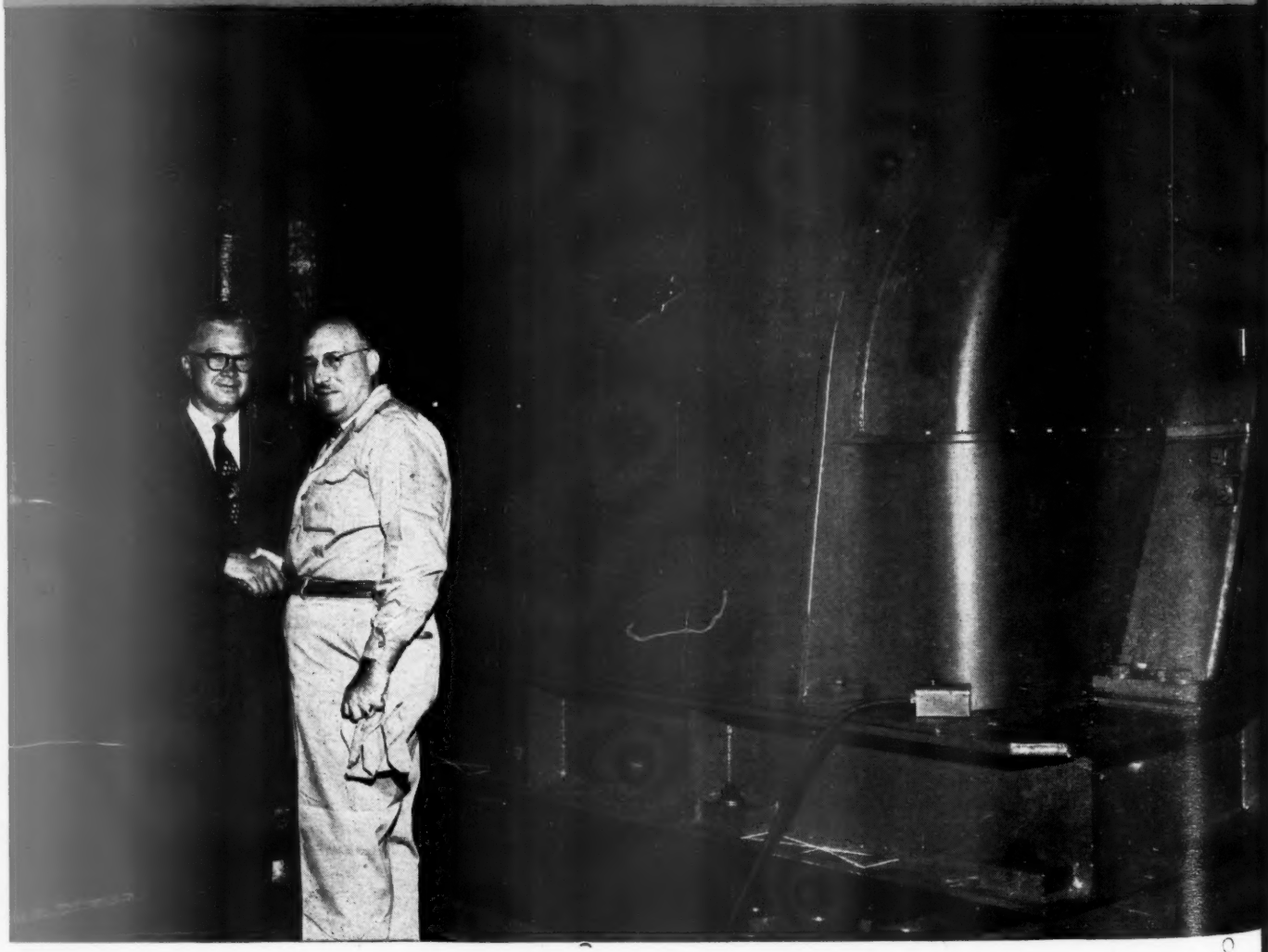
Refineries	Capacities in barrels		
	Crude	Thermal	Catalytic
Phillips-Woodcross	4200	800	—
Salt Lake Refining Company	27,000	—	13,000
Utah Oil Refinery	23,500	7200	12,300
Western State	3500	—	—
Uintah Oil Refinery, Jensen, Utah (Co-op)	1250	300	—
Total	59,450	8300	25,300

Future of the Uintah Basin

An area as large as the Uintah Basin covering 15,000 sq miles has room for many fields, each of considerable areal extent. Measured by experience in other areas it is not out of line to expect 40 to 50 new gas and oil fields in the Uintah Basin at depths ranging from 3500 to 15,000 ft with as many as 12 pay zones in the area. The Uintah Basin should become one of the important oil-producing sections of North America, but its development will not be as rapid as in other places since the area is controlled by major oil concerns with large unitized blocks. ★ ★ ★

World's Biggest Pipeline Motors!

3000 Horsepower Motors Pass History Ma



Pipeline news! Now being installed are four new booster stations on the Basin pipeline system, owned and operated on an undivided interest basis by the Texas Pipe Line Company, Shell Pipe Line Corporation, Sinclair Pipe Line Company and Cities Service Pipe Line Company. Each station will use two multi-staged centrifugal pumps, each pump driven by a 3000 hp, 1750 rpm, squirrel-cage induction motor.

These are the largest electric motors and centrifugal pumps ever built for pipeline service, *doubling the horsepower of any motors previously used for oil pipeline pumping*. Recently these motors and pumps passed rigorous acceptance tests at Oakland, California.

It was a big job from start to finish. Starting the 3000 hp motors across-the-line without a large voltage drop and resulting disturbance to the power line was the critical factor in motor design. E-M engineers, using a special design for the winding, slots, length of magnetic core, and various other factors, were able to make the starting current low enough to keep the voltage drop within the specified limits . . . still furnishing sufficient torque to accelerate the motor and pump to full load speed with

Making Acceptance Tests

open discharge. By holding motor losses to a minimum and correctly balancing other elements of the design, they were also able to achieve the desired high efficiency and high power factor.

Also extremely important was reliability. The motors have to stay on the job efficiently in around-the-clock pumping station operation. E-M engineers built this dependability into the motors with vacuum pressure impregnated coil insulation of high dielectric strength, precision rotor balance for minimum vibration at high speed, and a tough, rigid frame of welded heavy steel plate designed to withstand any stresses encountered in service.

Left . . . 3000 hp, 1750 rpm squirrel-cage induction motor with enclosing covers for forced ventilation driving a three-stage 14-inch centrifugal oil pipeline pump, on test.

WILL INCREASE PUMPING CAPACITY OF SYSTEM

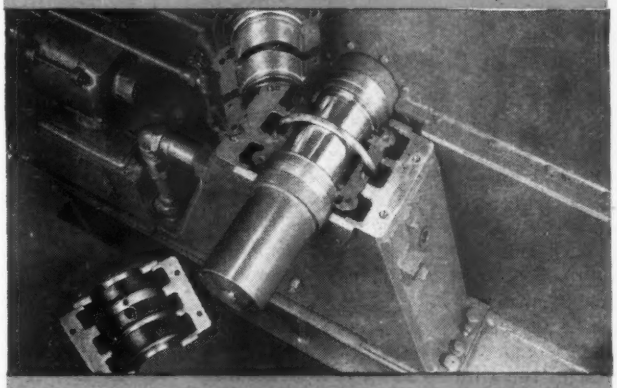
When installation is completed, eight of these 3000 hp motors plus seven 1250 hp units of similar type will help add 100,000 barrels per day, increasing by 40% the pumping capacity of the system.

Looking ahead to future benefits, the entire job from problem to solution is a notable engineering achievement in substantially increasing practical unit size of pipeline equipment. *E-M Synchronizer* No. 34 carries a detailed story on the design of these big motors. Write the E-M factory and ask for it.

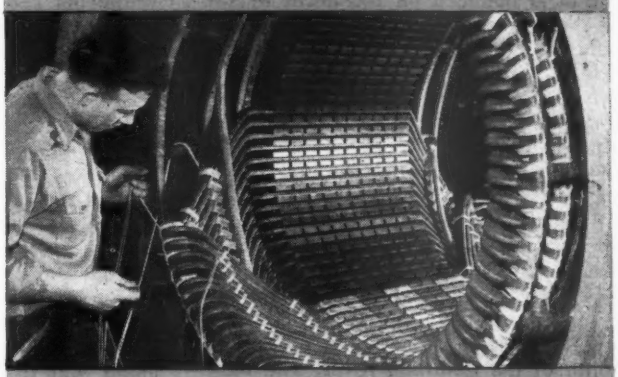
ELECTRIC MACHINERY MFG. COMPANY
MINNEAPOLIS 13, MINNESOTA

The superfinishing machine below applies an oscillating "harmonic motion" to the bearing journal of E-M's big motor, honing it microscopically smooth. Result is minimum friction and cool running at high motor speeds.

Pedestal type bearings are lubricated systematically by a separate motor-driven pump which forces oil into the bearings. A special oil ring gives sufficient lubrication for starting and acts as an added safety factor. Bearings are made by precise Kolene process centrifugal casting.



Coil ends are "lifetime lashed" to each other and to heavy bracing rings. High strength, neoprene-treated spunglass cord is used for coil lashing. As a result, this coil end structure of high rigidity and great strength is able to resist distortion from full voltage starting.



E-M

Specialists in

Big Motor Engineering

1300-TPA-2108

To obtain more information on products advertised see page E-41

AREA OF PROMISE

Piceance Creek Basin of Colorado A Portion of the Uintah Basin

Utah side of Uintah Basin has been getting more attention since discovery of the Roosevelt field in 1949—the Colorado side has proved its value but has had only limited exploration

ROBERT W. BLAIR AND LEONARD W. HEINY

THE Piceance Creek Basin is a large sub-division of the Uintah Basin and is restricted entirely to western Colorado. It comprises an area of about 6000 square miles, elongated in a northwest-southeast direction, mainly in Moffat, Rio Blanco, Garfield, Mesa, and Gunnison counties. The division that sets off the Piceance Creek Basin as a separate unit of the Uintah Basin is a structural high trending south from the Rangely Anticline toward the town of Mack in the Colorado River Valley. This high is known as the Douglas Creek Uplift. The Basin is bounded on the north by the southeast extension of the Uintah Mountains; on the east by the Grand Hogback, the west expression of the White River Uplift; and on the south by the Uncompaghre Uplift. It is drained by the Colorado River on the south and the White River on the north.

The Piceance Creek Basin does not in all places present the appearance of a topographic basin. Elevations range from about 5000 ft near Grand Junction to 12,714 ft on Mount Gunnison in Gunnison County. Both the lowest and highest elevations in the Basin are at or south of the Colorado River. The bulk of the Basin is north of the river and here it is a topographic, as well as a structural Basin. Dips are generally low in the Tertiary beds and slightly higher in the underlying Cretaceous beds. They range from less than 1 to about 8 deg on the south, west, and north sides of the Basin, but are much steeper, in some places as high as 60 deg, in the Tertiary along the Grand Hogback to the east. These steep west dips, however, flatten rapidly to 5 deg or less within a few miles of the Hogback.

The Basin is assymetrical as are most Rocky Mountain Tertiary basins with the axis nearer the east or steep side. The axis trends northwest from the southeast corner of the Basin to join the well defined Uintah Basin axis just south of the Rangely Anticline. Several smaller axes can be projected north from the main axis and one of these trends into the area known as Coyote Basin. This sub-basin appears to be the result of an embayment during Tertiary deposition.

Stratigraphy

The Piceance Creek Basin is covered entirely by Tertiary sediments with the exception of a fringe of Cretaceous sediments and a few scattered Cretaceous outcrops south of the Colorado River. The only information available on the pre-Cretaceous formations in the Basin is from wells drilled for oil or gas in and around the Basin and from measured sections outside the Basin. It is from these sources that the stratigraphic column was compiled.

CENOZOIC (Tertiary)

Eocene

Uinta (Bridger) formation. The Upper Eocene Uinta formation in the Piceance Creek Basin is composed of about 400 ft of brown massive cross bedded sandstone and grey sandy shales lying disconformably on the Green River formation but with an irregular contact. Differential compaction and channel fills are common at the contact. The Uinta formation, as here described, is the equivalent of Bradley's[3], Bridger formation. The formation is here called Uinta because of its striking similarity to lower Uinta beds at Watson, Utah, just west of the Colorado-Utah line.

Green River formation. The middle Eocene Green River formation is composed of oil shales, marls, siltstones, and a few thin limestones and algal reefs and is generally grey to buff in color. It has been divided in this Basin in descending order into the Evacuation Creek, Parachute Creek, Garden Gulch, and Douglas Creek members.

The Evacuation Creek member of the Green River formation is a mapable unit consisting of about 530 ft of brown to brownish-grey shale and marlstone that are limy, thin-bedded, and locally sandy, and some fine-grained, dark-brown sandstones. Near the base, the Evacuation Creek member contains a few thin oil shales.

The Parachute Creek is the most important member from a commercial standpoint of all the Green River members in the Piceance Creek Basin as it contains the bulk of the oil shales. This member ranges from 175 to 1200 ft in thickness and is made up predominately of thin-bedded calcareous oil shales and marls that weather light-buff to bluish-grey, and a few thin oolitic and algal limestones. The richer oil shale beds are normally cliff-forming and make this unit as a whole a cliff-former. The member is roughly divided into three zones with the upper zone containing one-third oil shale and two-thirds marlstone with a few thin sandstones and altered volcanic ash beds, a middle zone of marlstone and a lower zone of oil shale with some marlstone.

The oil shales occur in beds that range from a fraction of an inch to 10 ft in thickness and have varying yields of oil per ton with the upper zone of the Parachute Creek the richest. This zone also contains the rich "Mahogany Ledge" oil shale. The commercial aspects of this Green River member will be discussed later in the paper.

The Garden Gulch member is made up of grey to buff paper shales and marls from 200 to 700 ft in thickness and weather to a light-grey sloping out-

EXCLUSIVE

crop. Many of the shales are low grade oil shales. A few thin sandstone and siltstone beds are present in this member, as well as a few beds containing algae and oolites.

The Douglas Creek member is composed of 200 to 800 ft of alternating beds of grey to brown sandstones and siltstones, grey, green, and brown shales and some oolitic limestones and algal reefs. Sands in this member produce gas in the Piceance Creek Dome. The Douglas Creek member is the only gas- or oil-producing member in the Green River formation, and is therefore, of special interest.

Wasatch formation. The lowest Tertiary formation in the Piceance Creek Basin is the lower Eocene Wasatch formation composed of variegated shales, siltstones, and medium-grained to conglomeratic brown to grey sandstones. The shales are predominating and range in color from grey to red with red hues being the most common. Conglomerates are common in the lower part of the Wasatch in the southeast part of the Basin and grade into sandstone to the west. Near the Douglas Creek Uplift there are no conglomerate beds and little sandstone.

The thickness of the Wasatch is quite variable ranging from 6347 (?) ft in the Piceance Creek Anticline to less than 1000 ft measured on the Douglas Creek Uplift. Apparently, this Uplift was a high during at least part of the Wasatch deposition. The thickest part of the formation would be expected near the Basin axis and this appears to be true in this Basin, as the total of 6347 ft of Wasatch is reported in the deep well on the Piceance Creek Anticline. The well was drilled to 12,019 ft by the General Petroleum Corporation in Section 15, Township 2 South, Range 96 West. This location is just a few miles north of the Basin axis. The thickest measured section occurs near the town of Rifle where 3900 ft were observed.

MESOZOIC

Cretaceous

Mesa Verde sandstone. The Mesa Verde consists of brown, buff, and grey cliff-forming sandstones and grey shales with intervening coal beds. Thickness is about 3000 ft on the north, averages around 2300 ft on the southwest and is about 1000 ft thick in the extreme southern part of the Basin.

Mancos shale. The Mancos is a marine deposit consisting of dark-grey shale with beds of sand, limestone, and bentonite. Thickness of the Mancos ranges from 5300 ft on the north to 4000 ft on the southwest and to around 4500 ft on the southeast.

Dakota sandstone. The Dakota consists of brown to grey massive friable sandstone in places interbedded with carbonaceous shale and with conglomerate at the base. Thickness ranges from 40 to 150 ft.

Jurassic

Morrison formation. The Morrison formation consists of variegated green, grey, purple, and red shales, interbedded with lenticular limestone, sandstones, and conglomerates. Thickness ranges from 440 ft at Divide Creek in the southeast part of the Basin to 685 ft at Rangely on the northwest.

Summerville formation. The Summerville formation consists of red and brown shale and grey and pink marly limestones. A thickness of 40 ft was reported in the subsurface at Asbury Creek, and in wells on the Garmesa Anticline. The beds resemble those of the Morrison and are possibly included with that formation to the north and to the east.

Curtis formation. The Curtis formation consists of grey shales, glauconitic sands, and limestones. Where present at the north and west sides of the Basin, thickness ranges from 30 to 110 ft. Curtis was not reported in the subsurface at Meeker Dome nor in surface exposures on Elk Creek in Township 4 and 5 South, Range 91 East.

Entrada sandstone. The Entrada is a white to grey fine-grained sugary sandstone 135 ft thick at Rangely, and is probably included in what is reported as Sundance at Meeker Dome. The thickness is 125 ft southwest of the Basin on the Uncompaghre Uplift.

Carmel formation. This formation, which is probably correlative with the Twin Creek limestone of the Uintah Basin to the west, is composed of grey, black, and red shales with some red sandstone. On the northwest side of the Basin at Rangely, the formation is 65 ft thick. Carmel is also reported at Douglas Creek.

Navajo sandstone. The Navajo sandstone is buff to red fine-to medium-grained and exhibits characteristically cross-bedded exposures. The thickness at Rangely is 685 ft. This formation may possibly pinch out around the north end of the Basin as Navajo is not recognized in the subsurface at Meeker Dome. Some of the sand designated as Sundance could, however, represent Navajo.

Wingate and Kayenta formations. The Wingate sandstone is described as tan to brownish-red massive cross-bedded sandstone, which usually weathers to form almost perpendicular cliffs. Beyond the south rim of the Basin, the formation is from 240 to 300 ft thick and thins eastward to Elk Creek where a thickness of 40 ft was measured. At Elk Creek the Wingate is overlain by Entrada, and on the Uncompaghre the Wingate is separated from the Entrada by about 100 ft of red and lavender sandstone and siltstone known as the Kayenta formation.

Triassic

Chinle formation. The Chinle consists of brick red silty calcareous shales, mudstones, and some thin sand stringers. Thickness ranges from 135 ft at Rangely and Wilson Creek at the north end of the Basin to 380 ft at Elk Creek. Near the southwest edge of the Basin, only the upper part of the Chinle consisting of from 65 to 90 ft of shales and silts overlap the pre-Cambrian complex.

Shinarump conglomerate. The Shinarump is a cream to red lenticular sand body composed mainly of quartz-grains ranging in size from fine to pebbly. Thickness ranges from a thin edge to more than 150 ft.

Moenkopi formation. The Moenkopi formation consists of red, pink, purple, and greenish-grey shales and siltstones with some gypsum in the lower part. The thickness ranges from around 600 ft at Rangely to 200 ft at Douglas Creek. On the east side of the Basin well cuttings at Meeker Dome indicate possibly less than 200 ft. No Moenkopi was noted at Elk Creek.

PALEOZOIC

The oldest rocks penetrated in deep wells in the Piceance Creek Basin are on the east side. Similarly, surface exposures of the oldest rocks are located to the east of the Basin. Wells drilled on the southwest edge of the Basin have encountered no Paleozoic rocks. In that part of the Basin, Triassic rocks overlap the pre-Cambrian complex of the Uncompaghre Uplift. Paleozoic strata may have been deposited in what is now the southwestern part of the Basin and were later eroded after the close of Mississippian time when the Uncompaghre was uplifted as part of the "Ancestral Rockies".

Permian

Park City (Phosphoria) formation. As identified in wells on the north and west sides of the Basin, the Park City consists of varicolored shale, sandstone, and silty shale. The thickness is quite

The Authors

R. W. Blair L. W. Heiny

Robert W. Blair, a native of Colorado, was graduated from the University of Colorado, Boulder, Colorado, in 1938. He spent a year with U. S. Geological Survey and Gravity Service Company. He joined the U. S. Army Air Force as a pilot and was discharged in October, 1946. Blair spent six months with U. S. Geological Survey and then joined Continental Oil Company in early 1947. He is now division geologist, Salt Lake City division. He published U. S. Geological Survey Oil and Gas Investigation Chart OC 42, "Subsurface Geological Cross-Sections of Mesozoic Rocks in Northeastern Colorado (1951)."

Leonard W. Heiny is a native of Colorado. He was graduated from the University of Colorado with B. A. Degree in geology in 1949, and has been employed as geologist by Continental Oil Company since that time.

Above: Five of the fifteen Cooper-Bessemer GMW engine-driven compressors in Michigan-Wisconsin Pipe Line Company's Guymon-Hugoton Station, showing units from scavenging blower end. Each has 10 power cylinders and drives 3 compressor cylinders.

Right: Five GMW's in Transcontinental's Saint Francisville Station.

Extreme Right: Two of four GMW's in Panhandle Eastern's Liberal, Kansas Station.

ANGLE

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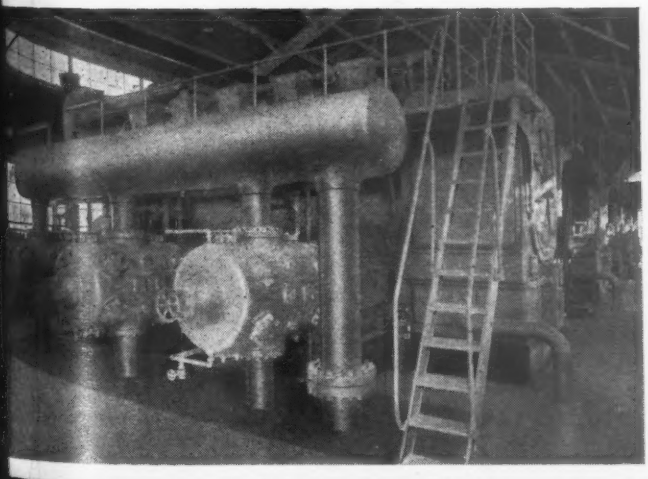

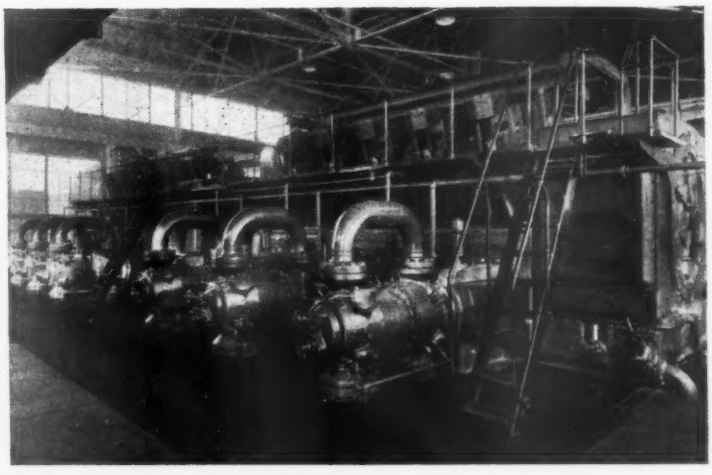

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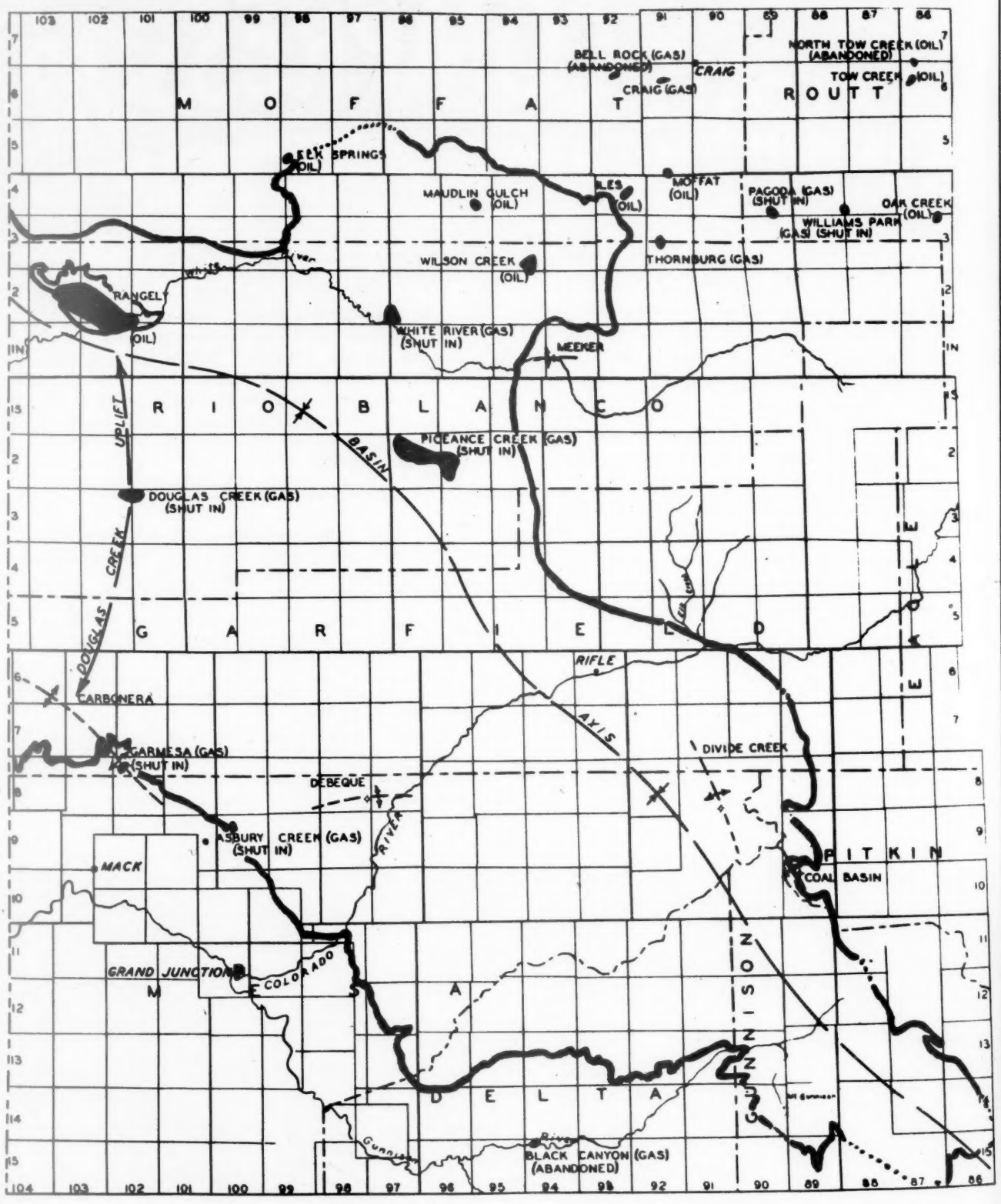
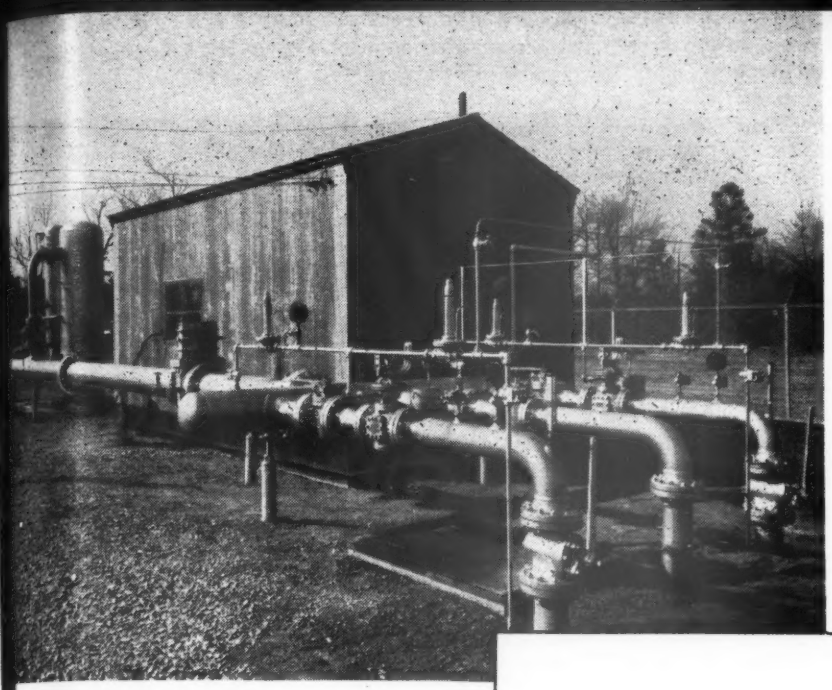


PICEANCE CREEK BASIN, WESTERN COLO.
OUTLINED ON BASE OF MESA VERDE

The Colorado portion of the Uintah Basin, showing oil and gas fields. The heavy line indicates the size of the basin. See Page A-41 for outline of entire basin in Utah and Colorado.



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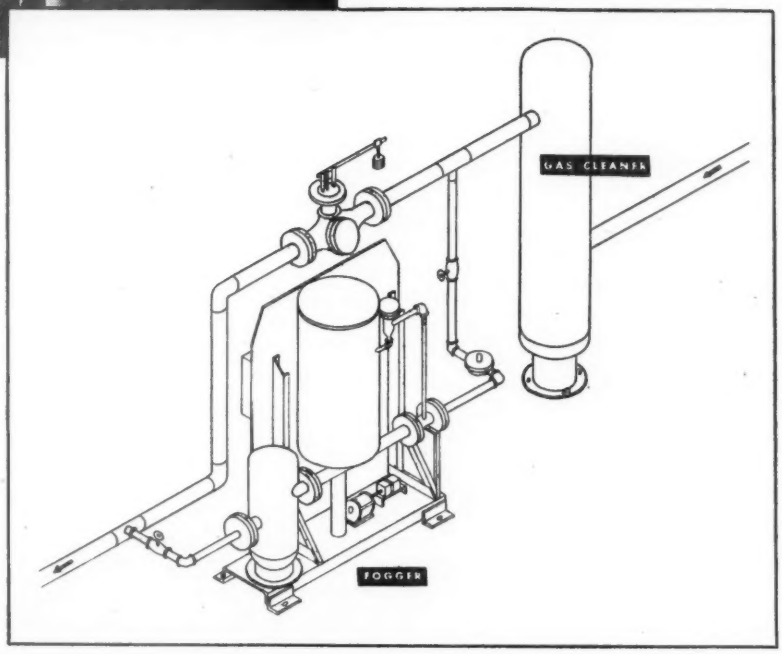
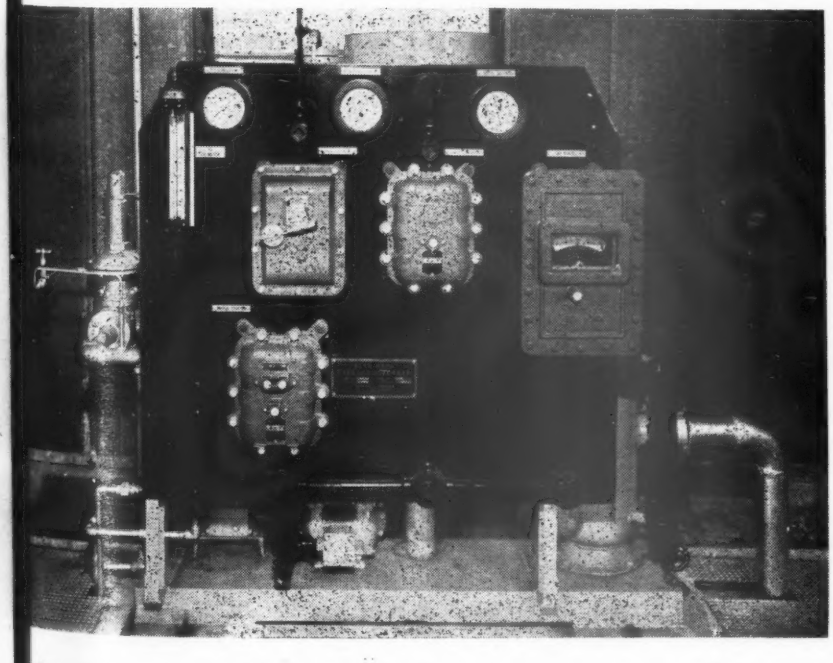
The diagram shows the *Right Combination* to insure delivery of clean, conditioned gas. Both Cleaners and Foggers are standardized units—quickly installed and requiring the minimum of maintenance or supervision.





Between cleaners and distribution lines Blaw-Knox Oil Foggers perform a highly valuable service. The fine particles of oil fog suspended in the gas stream drop out gradually and uniformly on the inner surface of the entire pipeline system, wetting down old dust deposits, moistening leather diaphragms, and preventing drying out of packing in bell-and-spigot pipe joints. Many fogger installations in 1951 attest the value of fogging and the popularity of Blaw-Knox Foggers.

Blaw-Knox has the facts and figures to prove that *you cannot afford dirty gas.* More than 20 years' service to the gas industry, plus continuing research, show conclusively that operating and maintenance expenses due to pipe line dust cost more than the installation of Blaw-Knox Gas Cleaners and Foggers.

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BLAW-KNOX DIVISION
OF BLAW-KNOX COMPANY
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variable, from as little as 12 ft on the north to 240 ft on the east. The contact with the overlying Moenkopi is gradational and no apparent unconformity separates the Permian from the Triassic.

Pennsylvanian

Weber sandstone. In the northwestern part of the Basin where the Weber was drilled on the Rangely anticline, the upper one-fourth is composed of fine-grained grey massive cross-bedded sandstone. In the lower three-fourths the red color increases down section and changes to red arkosic sands and micaceous shales with a few limestone beds. The contact with the underlying Morgan formation is transitional and a lower contact for Weber is rather indefinite; however, 1200 ft is considered to be the thickness at Rangely and may be considered average for the north and east sides of the Basin. On the west, the formation thins to around 900 ft on the Douglas Creek Anticline where red sandstones, shale, and arkosic conglomerates predominate.

Morgan formation. On the northwestern side of the Basin, the Morgan formation consists of three members which total around 1200 ft. The upper member consists of grey hard limestones and red to white arkosic sandstones; the middle member contains cherty, fossiliferous limestones with grey dolomite and marl and some shale; the lower member is mainly grey, yellow, and red sandstone and conglomerate with some black shale, dolomite, and limestone. On the east side of the Basin in the well on the Meeker Dome almost 3000 ft of probable Morgan equivalent was penetrated by the drill. Here the formation consists of arkosic sandstone, grey dolomite, and dark grey limestones interbedded with gypsum and anhydrite in the upper part. The lower part is predominately grey, brown, and black cherty limestone with some sand and dolomite. A similar sequence of thick Pennsylvanian strata is probably extensive over the southeastern portion of the Basin.

Molas formation. The Molas formation, which is a distinctive marker bed in wells in southwestern Colorado, has been identified in wells on the east side of the Basin and ranges in thickness from 30 to 50 ft. It consists of green to black and red shales and red sandstone.

Mississippian

Madison limestone. The Madison limestone consists of cream to tan, medium to coarsely-crystaline cherty limestone with interbedded black shale, and cream to brown dolomite. Surface exposures and well data show the thicknesses to be about 250 ft on the east side of the Basin. To the north a measured section indicates as much as 415 ft. The Madison lies unconformably on the Chaffee formation and is believed to be lower Mississippian in age.

Devonian

Chaffee formation. This formation consists of an upper dolomitic member and a lower sand and quartzite member. The dolomites are cream to dark-brown finely-crystaline with interbedded limestone and grey and green shales. The lower member exposed on the surface at Elk Creek consists of thin-bedded grey quartzite and dolomite with green shale. The lower member is apparently not as quartzitic in the subsurface at Meeker Dome as on the surface at Elk Creek. Thickness for the entire unit ranges from 230 ft at Elk Creek to 80 ft at Meeker Dome. The two members are separated by an unconformity.

Ordovician

Manitou limestone. Manitou ranges in thickness from 235 ft at Elk Creek to 124 ft at Meeker Dome. This formation consists of pink to red and green glauconitic dolomite with some grey-green micaceous shale and some red shale. In surface outcrops the Manitou apparently is conformable on the Sawatch but is unconformable with the overlying Chaffee formation.

Cambrian

Sawatch quartzite. Surface exposures of this formation at Elk Creek consist of grey, green, and buff dolomitic sandstone and quartzite. In the subsurface the upper beds are described as green and pink slightly quartzitic to quartzitic and with dolomite cement. The formation is considered Middle Cambrian in age.

Igneous Rocks

There are few outcrops of igneous rocks in the area and these are all located south of the Colorado River. On Battlement Mesa in Garfield and Mesa counties and on Grand Mesa in Mesa and Delta counties are found large remnants of late Tertiary or early Quaternary Andesite and Basalt flows. Farther southeast are exposures of Monzonite intrusives and it is a laccolithic intrusion of this type that forms Mount Gunnison, which has the highest elevation in the Basin. At the very southeast tip of the Basin are outcrops of possible Miocene agglomerate and breccia.

These igneous rocks should have little effect on the oil and gas possibilities of the Basin.

Development

Structures

The structures here described are listed in a counter-clockwise direction around the Basin beginning with the Coal Basin Anticline on the extreme southeast and ending with the DeBeque gas field on the south. Some of the structures described are within the Piceance Creek Basin boundary as drawn on the base of the Mesa Verde and some lie just outside this boundary. Actually the basinward dips extend some distance outside the boundary shown but as we are primarily interested in the Tertiary part of the Basin the limits were drawn so as to include most of but not all the basinward dipping beds.

Coal Basin anticline. The Coal Basin structure in Township 10 South, Range 89 West, Pitkin County is a northwest southeast-trending faulted anticline. It has a closure of 1500 ft exclusive of the faulting. Two wells have been drilled on the structure with the deepest, 4464 ft, testing Dakota. This well bottomed in igneous material with no encouraging oil shows.

Divide Creek anticline. Divide Creek anticline is a northwest southeast-trending assymetrical structure with about 1900 ft of closure. It is situated near the southeast edge of the Piceance Creek Basin in Township 7 to 9 South, Range 90 to 92 West, Garfield and Mesa counties.

One deep well has been drilled on this structure to a total depth of 11,942 ft and bottomed in the Entrada sandstone of Jurassic age. It was plugged and abandoned in 1945 with no encouraging shows of oil or gas.

Piceance Creek anticline. The Piceance Creek structure is a northwest southeast-trending anticline in Township 1 and 2 South, Range 95 and 96 West, Rio Blanco County, Colorado. This structure is located just north of the Basin axis with its surface expression in the Uinta formation. Surface maps show a closure of 250 ft.

Gas was discovered in the Douglas Creek member of the Green River formation and to date several producing wells have been drilled. The field is now shut in due to lack of market. One deep well was drilled to 12,019 ft and bottomed 2457 ft in the Mesa Verde formation. No promising shows were encountered in this well below the known producing horizon.

White River dome. The White River dome is a structure in the Tertiary Wasatch formation, north of the Basin axis in Township 2 North, Range 96 and 97 West. It has an east-west trend and about 400 ft of closure. Gas was first discovered here in 1890 and since then about 7 wells have been drilled, all of which found small quantities of gas in the Wasatch formation. The deepest well to date penetrated some 900 ft of Mancos shale with a total depth of 8520 ft.

Meeker dome. The Meeker dome is an east west-trending anticline of about 1250 ft of closure located in Township 1 North, Range 93 and 94 West, Rio Blanco County. This structure was drilled to a depth of 6645 ft in 1945 and bottomed in Cambrian Sawatch formation. No encouraging oil or gas shows were found.

Wilson Creek anticline. The Wilson Creek oil field in Township 2 and 3 North, Range 93 and 94 West, Rio Blanco County, is situated on a large anticline with about 1000 ft of closure. The discovery well was drilled in 1937 and found production in Jurassic Morrison sand. Other later wells found deeper production in the Entrada sandstone. Thirty-three producers have been drilled since the discovery well. One other well is drilling as this report is being written.

A deep well was drilled to Cambrian

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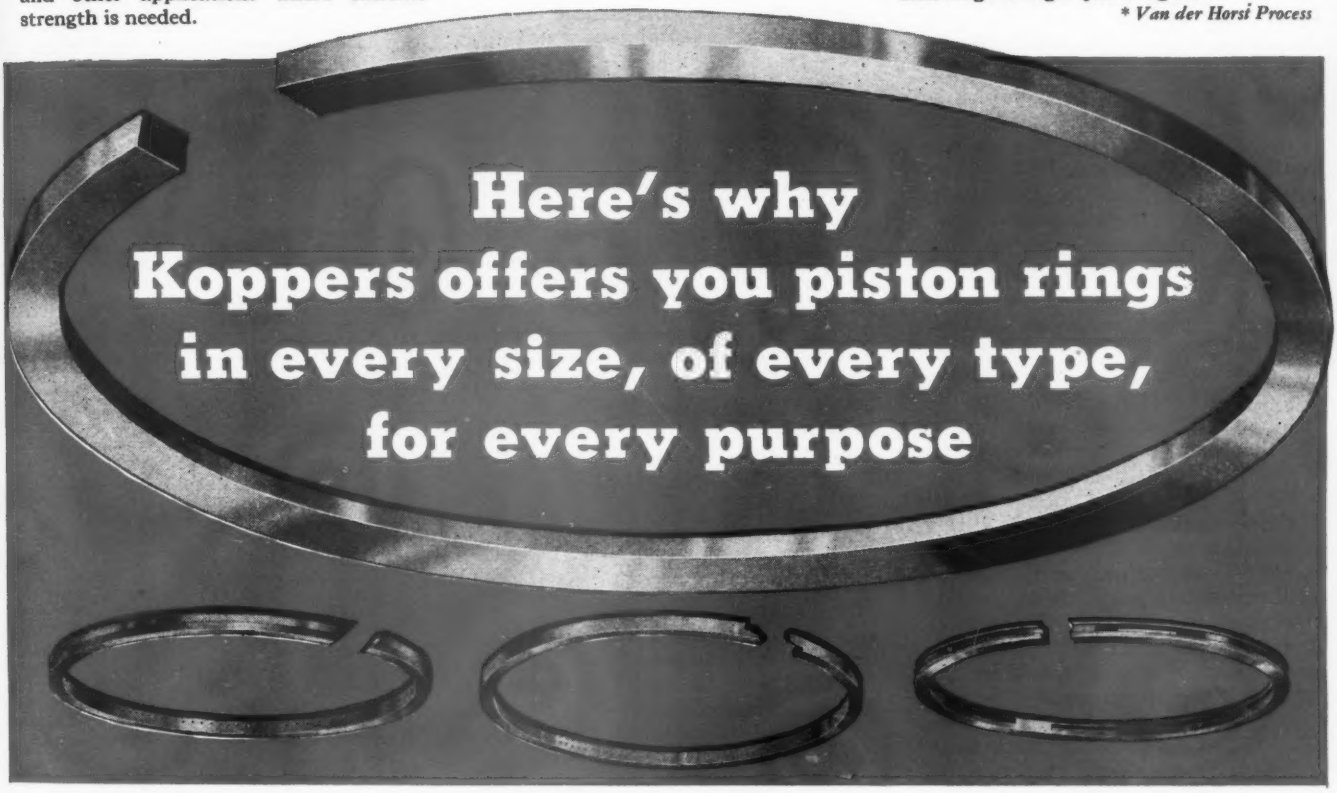

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sediments with a total depth of 12,702 ft. No deep production was discovered and the well was plugged back to the Entrada.

Maudlin Gulch anticline. The Maudlin Gulch structure is an assymetrical northwest southeast-trending anticline with a closure of approximately 170 ft. It is located in Township 4 North, Range 95 West, Moffat County. The discovery well was drilled in 1947 with oil production from Morrison sands. Later wells established production in the underlying Entrada or so-called Sundance sandstone. To date 8 wells are producing on the structure from a depth of 6100 to 6400 ft. No deep pre-Jurassic wells have been drilled.

Elk Springs anticline. The Elk Springs structure in Township 5 North, Range 98 and 99 West, Moffat County, is a small northeast southwest-trending faulted anticline with about 125 ft of closure. The oil discovery was made in the Weber sandstone in 1946. Three wells are currently producing. The deepest well drilled in the field was bottomed at 6300 ft in the Weber formation.

Rangely anticline. The Rangely oil field is on a large northwest southeast-trending assymetrical anticline in Township 1 and 2 North, Range 101 to 103 West, Rio Blanco County. It has a closure of about 1400 ft.

Although oil was discovered here in 1902 the commercial development did not take place until 1944. The main producing horizon is the Weber sandstone of Pennsylvanian age with relatively minor amounts of oil being produced from the Triassic Shinarump sandstone and Cretaceous Mancos shale. Production now amounts to about 65,500 bbl of oil daily from some 530 wells. The deepest formation penetrated on the structure is the Morgan, and it is nonproductive. No hole has ever been drilled to test the Mississippian beds.

Douglas Creek anticline. The Douglas Creek anticline is situated on the Douglas Creek Uplift in Township 2 and 3 South, Range 101 and 102 West, Rio Blanco County. It is a highly faulted east west-trending structure with about 800 ft of closure. This closure indicated on the surface may be unreliable because of the highly faulted condition of the anticline.

The discovery gas well was completed in 1943 and is located in Section 5 Township 3 South, Range 101 West. The producing formation is the Dakota sandstone topped at 4210 ft with production gaged at 9,700,000 cu ft of gas per day. Three additional wells, of which two were producers, were drilled on the structure. For lack of market, however, all three wells are shut in. The deepest formation tested is the Morgan with a total depth of 8558 ft.

Asbury Creek - Garmesa - Carbonera anticlinal trend. The Asbury Creek-Garmesa-Carbonera trend is a series of anticlines of low relief in Mesa and Garfield counties. They strike northwest from Township 9 South, Range 101 West. Faulting is common along this trend and closures are slight.

Numerous wells were drilled, with the first gas discovery made in 1925 on the Garmesa structure. Since then gas has been found in commercial quantities in several wells with the latest at Asbury Creek drilled in 1949. The main producing horizon is the Dakota sandstone series although some gas is found in Morrison and lower Jurassic sands. The gas contains a high carbon dioxide content.

The deepest wells along this trend drill from Triassic into pre-Cambrian at a shallow depth of about 4000 ft. As there is no present market for this gas, all wells are now shut in.

DeBeque anticline. The DeBeque structure is an east-plunging nose with possibly a small amount of closure and is located in Township 8 South, Range 97 and 98 West, Mesa County. The early development on this structure took place in 1902 and 1904 during which time 11 wells were drilled. Gas and oil were discovered in the upper Mesa Verde formation but production was low; 8 bbl of oil a day in the best oil well and 75,000 cu ft gas per day in the best gas well. Additional sporadic drilling has taken place since then but the field is now abandoned except for some local gas use. The deepest well bottomed at 3542 ft in Mancos shale.

Commercial Aspect of the Green River Oil Shale

The oil shale industry in Colorado expanded rapidly with the building of an oil extraction plant in 1947 by the U. S. Bureau of Mines near the town of Rifle. This operation is not commercial but is approaching that goal. The oil shale for this project is obtained from the nearby Roan Cliffs of Green River formation. Almost unlimited quantities of oil shale are available throughout the Piceance Creek Basin.

It is estimated that there are 1000 square miles of oil shale in the Piceance Creek Basin of economic importance and that these shales represent about 400,000,000 bbl of oil per square mile. This figure is based on an average yield of 15 gal per ton with an average thickness of 500 ft. The yields in the richer "Mahogany Ledge" are in places as high as 80 gal per ton but these yields are local.

Besides the oil shale in the Basin there are reported numerous accounts of tar seeps, bituminous sands, and small gilsonite veins in Tertiary and Cretaceous formations. Some of these may some day be of commercial value although now they seem rather insignificant.

Conclusions

With the tremendous surge of activity in oil exploration in Utah since discovery of Tertiary oil at the Roosevelt field in 1949, it seems that western Colorado has lost some of its attraction to oil men. As less and less land is available for leasing in Utah, however, the Tertiary and deeper plays will undoubtedly move east into the Piceance Creek Basin of Colorado. Here are several known fields producing gas and numerous fringe fields producing oil. Very little is actually known about the central part of the Basin and leasing is still relatively light.

The next few years will show a great increase in oil activity in the Piceance Creek Basin of Colorado.

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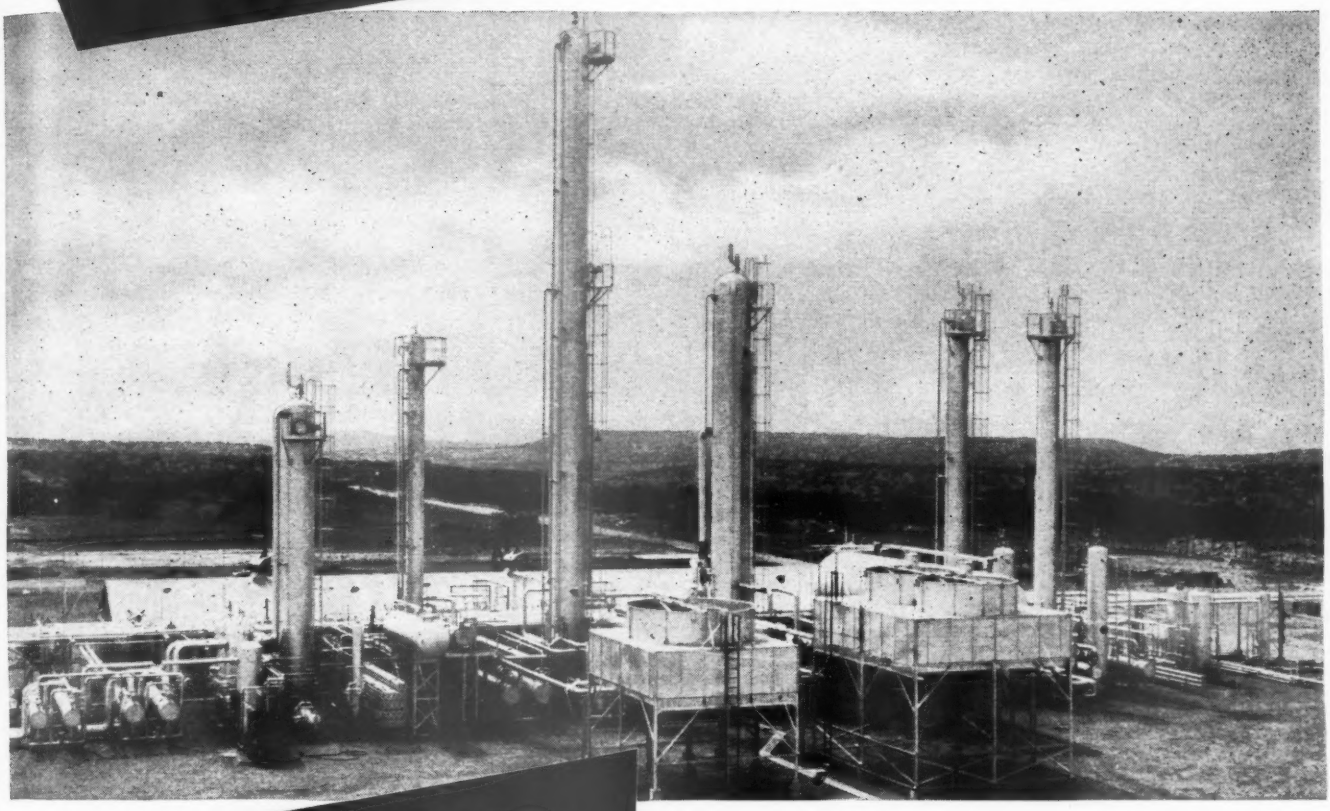

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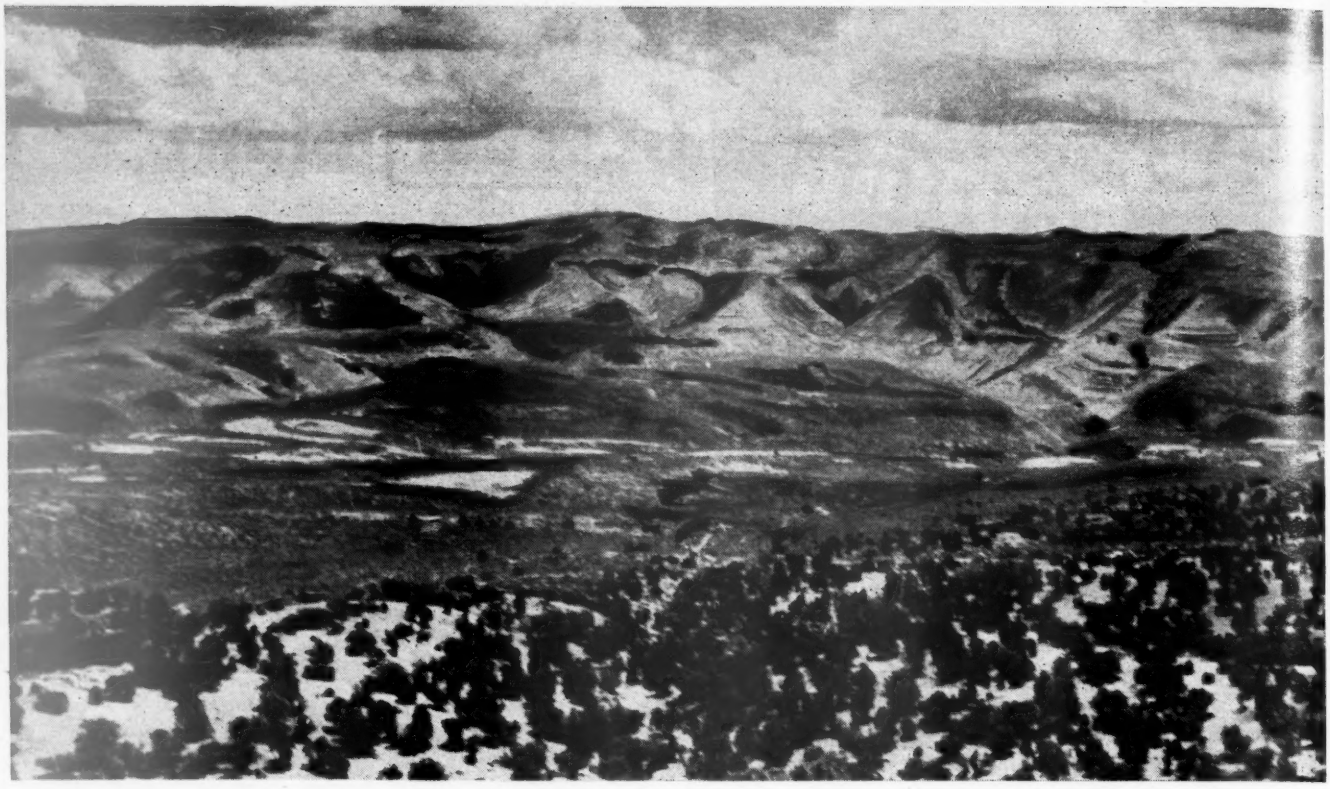

Panoramic view of the Bonanza area.

Petroleum Possibilities in the Uintah Basin

Geologists are divided on trend of greater potentialities—One group thinks Basin is Tertiary problem; another believes greater production will come from the Paleozoic formations

JOHN R. BUNN

AN intensive and systematic exploration program for oil and gas in the Uintah Basin of northeastern Utah and northwestern Colorado has been in progress for the past 2½ years. This exploration has been conducted by most of the major operating companies in the Rocky Mountain area and certain independents. Among the majors, Carter Oil Company, California Company, Stanolind Oil and Gas Company, Continental Oil Company, Sun Oil Company, and Gulf Oil Corporation have been the most active. This exploration has included intensive surface mapping, seismic, magnetic and gravity surveys, as well as production and shallow structural drilling.

*Petroleum Geologist, Johnson and Bunn.

In August of 1951 there were 70 field geologists, 8 seismic crews, and an unknown number of other geophysical parties working in the Basin. Fifteen rotary rigs were then drilling wildcat or extension wells. In January 1952, in spite of the roughest winter in the recorded history of the Basin, 15 rotary rigs and 6 seismic crews were still operating. Approximately 50 company geologists and petroleum engineers are now in their respective offices within the Basin area working up the results of this past and present exploration and laying plans for the contemplated drilling of 70 or more additional drilling operations, and the new field work that will commence with the melting of the winter snows.

EXCLUSIVE

Virtually the entire Basin area, with the exception of certain Indian Reservation lands is now solidly leased. The value placed on some of these unleased Indian lands was shown at a recent sale of Oil and Gas Leases of Ute Tribal lands. This sale was held at Fort Duchesne, Uintah County, Utah, January 25, 1952, where $456,414.33 was offered in sealed bids for 7019 acres in the Duchesne area, and $105,123.75 was bid on 5025.23 acres in the Fruitland area in Duchesne County.

The initial spark that touched off the Uintah Basin Tertiary play was the com-

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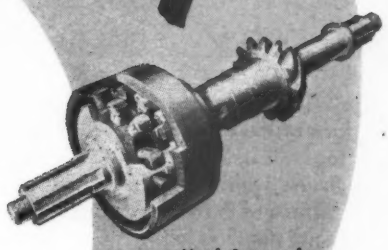

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Below is a small gilsonite fissure in the Bonanza area. In this photograph the wall rock on the right hand side is a permeable Uinta sandstone that has been impregnated with oil from the gilsonite before it solidified. The wall rock on the left hand side is a bentonitic shale entirely different from the saturated sand on the right. This shows there has been a displacement along the gilsonite fissure. The geologist shown in the photograph is Robert E. Covington, who is associated with Johnson and Bunn, oil operators.

Above is shown a cross section at the surface of the Bonanza fissure. The photograph is looking southeast down the fissure with certain moveable shaft structure in the background. The geologist standing in the fissure is Robert E. Covington.

pletion of Carter Oil Company, et al, Ute Tribal No. 1 well in Section 21, Township 1 South, Range 1 East, U. S. M., completed in June 1949. This well was bottomed in the basal Green River Formation of Eocene Age, at a total depth of 9300 ft. Production was from vertical fractures in calcareous shale and shaley lime. Initial production was 1600 bbl per day. The total production from this well to January 1, 1952, totals 440,000 bbl. This well was the discovery well of the Roosevelt field, which is now in the process of conservative unit development.

Since the discovery of Ute Tribal No. 1, a total of 29 wells have now been drilled in the Tertiary portion of the Basin. Of these 9 wells were dry holes, 15 wells were oil producers, 2 wells were gas wells, and 3 wells were drilled as exploration strat tests.

Recent additional important discoveries in the Uintah Basin include the California Company's Red Wash No. 1 well, discovery well of the important new Red Wash field, located in Section 26, Township 7 South, Range 23 West, Uintah County, Utah, completed in January 1951 with an initial production of 250 bbl, from a total depth of 5360 ft in sands occurring in the lower Green River Formation.

Johnson and Bunn and Stanolind's Barrows No. 1 discovery well, in the Hell's Hole area, located in Section 12, Township 2 South, Range 104 West, Rio Blanco County. Colorado, was completed in June 1951 at a total depth of 2495 ft in the basal Mesaverde sandstone, with an initial production of 11,200,000 cu ft of gas per day.

The Carter Oil Company and Continental Oil Company's Duchesne Ute No. 1, in the Duchesne area, situated in Section 17, Township 4 South, Range 4 West, Duchesne County, Utah, was completed August 6, 1951, at a depth of 7500 ft in fractured, calcareous formation of lower Green River or upper Wasatch Age, with an initial production of 525 bbl per day.

In December 1951 Johnson and Bunn completed their Watson No. 3 well in the Bonanza area in White River Canyon, in Section 34, Township 9 South, Range 25 East, Uintah County, Utah, at a depth of 923 to 954 ft, in a sand occurring in the lower Green River formation. The actual oil production of this well is unknown because of heavy snows shutting down operations. This well is a 900-ft offset to Watson No. 2, which was shut down in October 1951 at a total depth of 9504 ft, pending installation of a larger rig to continue to the Weber sandstone at an expected depth of approximately 11,000 ft. This shallow sand completion in Watson No. 3 well was the first of numerous sands carrying gas and distillate showings, that were passed up in the deeper well.

The Carter Oil Company in Section 21, Township 11 South, Range 21 East, Willow Creek No. 1 well, appeared to have some sort of a discovery in a sand occurring in the Mesaverde formation. Casing was set, but the well could not be brought into commercial production.

All these discoveries are scattered over a rather wide expanse of territory and indicate the upper stratigraphic oil and gas potentialities of this Basin.

Previous to the exploration campaign now underway in the Basin two prolific oil fields were developed on the northeast rim of the Basin. These fields were the Rangely oil field in Rio Blanco County, Colorado, and the Ashley Valley oil field in Uintah County, Utah. These fields are producing from Paleozoic formations. The Rangely oil field is producing from the Weber sandstone of Upper Pennsylvanian Age. Ashley Valley is producing from the Permian Phosphoria limestone and Weber sand.

Obviously with these important discoveries and widespread exploration underway, there has been considerable interest and speculation regarding oil and gas possibilities of the Uintah Basin. Since the area is isolated and removed from most of the better known oil areas of America, comparatively few oil and gas operators have visited the area, and therefore, are not familiar with the existing conditions and known facts concerning this interesting Basin. There are many different opinions and theories concerning the geology and the interpretation to be given the widespread occurrences of tar sands, fissure leakage and oil seepage that have caused the present exploration and intensive study now being given this Basin.

The writer has been working almost continuously in the Uintah Basin since March, 1949, and has had occasion to map the surface structure and strati-

graphy of several thousand square miles of rugged country over the eastern portion of the Basin. Large portions of this area were mapped by plane table survey. Other work was by reconnaissance and aerial photographs. Naturally with this much work and study a great many definite facts have been disclosed from which certain conclusions may be drawn as to the origin of the bitumen leakage and oil and gas potentialities of this portion of the Basin. The ideas and conclusions regarding the Uintah Basin that will be advanced here are the ideas and conclusions arrived at from this study and mapping of the surface formations as they occur through the east and northeastern portions of the Basin.

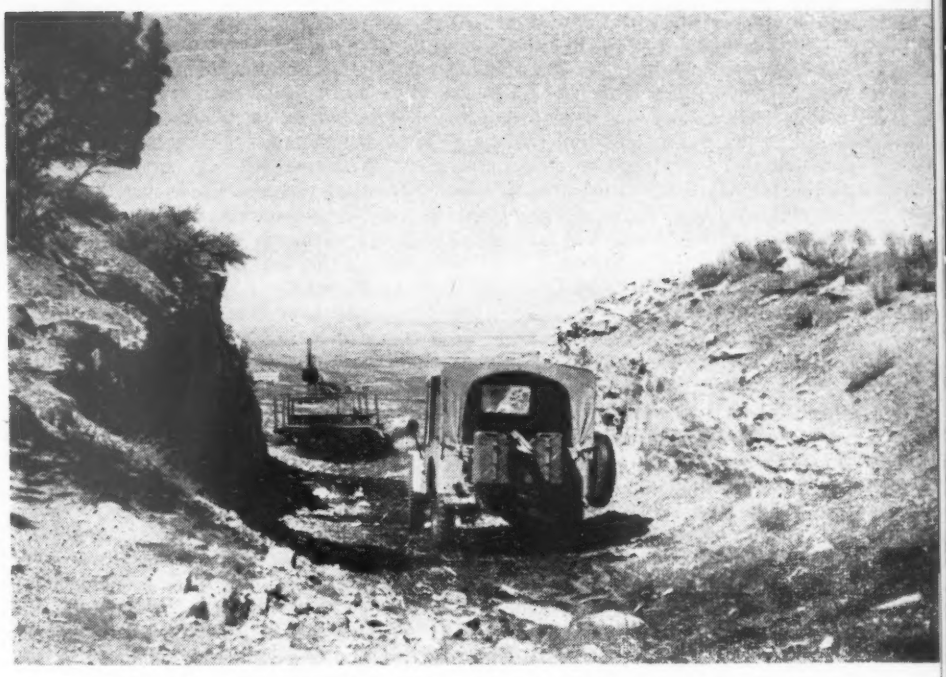
Geologists working in the Basin are definitely not agreed on many of the problems and the significance of the widespread hydrocarbon leakages occurring over the Basin. It would appear that these differences of opinion are due in part to the various geographical approaches from which the Basin is studied. From a general overall study of the Basin, this writer believes that a better picture of the structural mechanics and stratigraphic sequence can best be observed along the eastern and northeastern portions of the Basin. Here the mechanics of folding and faulting and progressive overlap in the various formations are more exaggerated and can be better observed than in any other portion of the Basin. Here also occur the greatest and most phenomenal petroleum leakage associated with fissures and eroded bitumenous sandstone.

For those not familiar first hand with this unusual and most interesting future petroleum province, the following brief discussion of the known facts, and geological and geographical features of the Basin may be of interest.

Salient Features of the Basin

Generally speaking the Uintah Basin is both a structural and topographic Basin. It is slightly elongate, trending in an east-west direction, with a length of approximately 142 miles and a width of approximately 110 miles. The approximate area of the Basin, including the area of Cretaceous and Eocene outcrops, is roughly 6,800,000 acres. The Uintah has a long, sedimentary history, 20,000 ft plus of sediments, including certain Paleozoic, Mesozoic, and Cenozoic formations, which can be mapped progressively from the eroded, upturned edges along the north flank into the central portion of the Basin. All formations appear to thicken rapidly into the deeper portions of the Basin, making this area very attractive from the standpoint of stratigraphic traps and wedgeout type reservoirs.

The Uintah area, geologically and geographically, is a land of contrasts. The mountainous flanks of the Basin offer spectacular surface geology and beautiful scenery. The Uintah Mountains, terminating the north flank of the Basin, are replete with deep canyons and gorges, snow capped peaks and clear, rushing trout streams. Mesozoic and Paleozoic formations of great thickness are exposed in the mountain uplift. These formations erode into beautiful canyons with sharp and spectacular features and shapes. The Uintahs are heavily wooded and abound with game. Elevations on several peaks exceed 13,000 ft. This area is truly one of the scenic and primitive spots of America.



Looking west and northwest along the strike of the Cowboy gilsonite fissure in the Bonanza area. The fissure here is almost 20 ft wide. It has been mined to a depth of approximately 900 ft in the shafts in the background.

In contrast, the interior of the Basin over the outcrops of a low, dipping Eocene and Younger formations is arid, desert country, presenting a barren, bleak, and desolate appearance—this is the area of present Tertiary drilling and exploration. Here is an area of truly great oil and gas potentialities, particularly in these and other formations. The possibilities are indicated by the magnitude of bitumen leakage and by important new producing well discoveries made within the past 30 months.

The fissure leakage is best developed in the eastern portion of the Basin, in the Bonanza-Hell's Hole area and the Rainbow-Dragon area. In the Bonanza area the fissures occur in a fractured zone approximately 6 miles wide and 17 miles in length. The fissures occur in

Cowboy fissure looking east, southeast. Note the displacement of approximately 5 ft shown between the wall rock on the right and left hand sides of the fissure. The down drop is to the right or north side. The fissure here is 19 ft 8 in. in width and has an overall mapable length of approximately 8 miles. The author is shown standing by the jeep.

length from a few hundred yards to as long as 8 miles. In the Bonanza area alone, the petroleum leakage necessary to fill the fissures with the gilsonite residue, has been variously estimated from 200 million to 2 billion barrels of petroleum. It seems reasonable from geological mapping and investigation that this seepage should represent only a portion of the original accumulation occurring along the easily observed Red Wash-Bonanza-Hell's Hole-Douglas Creek structural arch.

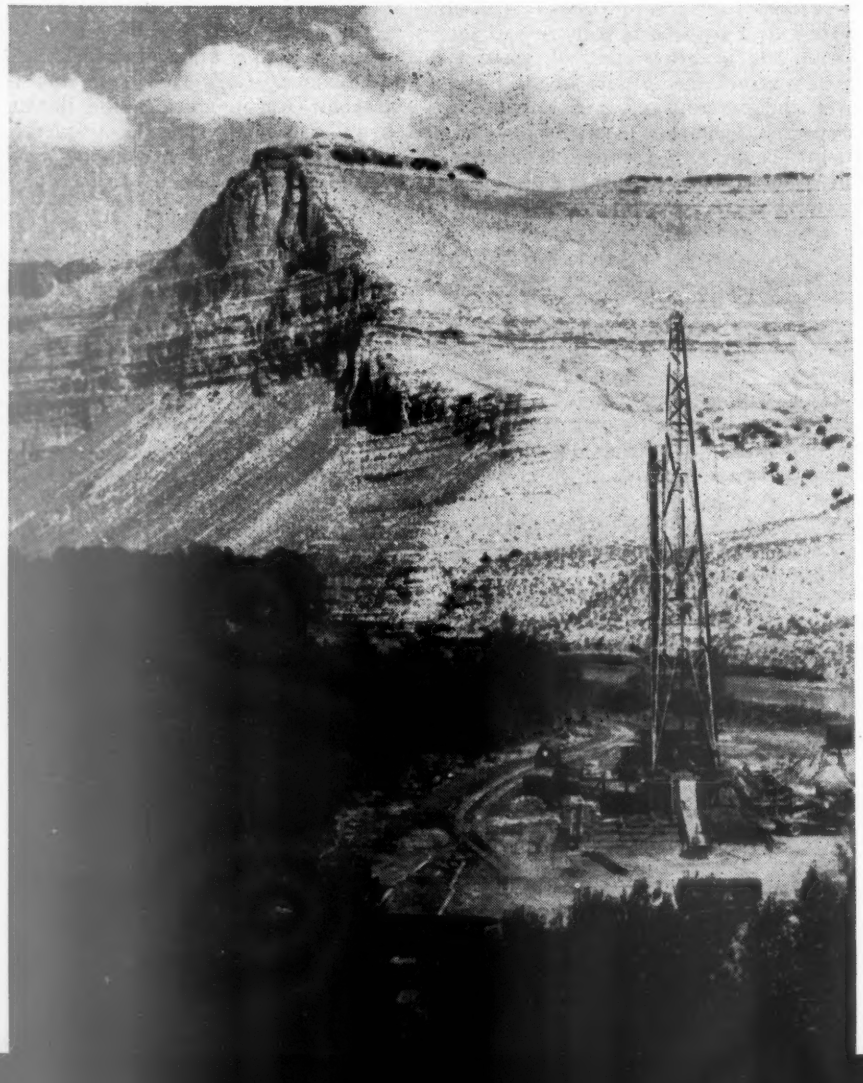
The Uintah Basin is also notable for the widespread occurrence of bituminous sands. These outcrops are present in all parts of the Basin, and the sands in which they occur range from Eocene to Pennsylvanian in age and are especially widespread in the Green River and Wasatch formations of Eocene Age. The best known localities of the sands are in the Sunnyside, Lost Soldier, Myton, Strawberry and Vernal areas. The Cretaceous Mesaverde sands are well saturated in the Vernal area, and the U.S.G.S.[1] has estimated bitumen of the Vernal reserves to exceed two to three billion barrels. North of the town of White Rocks on the north rim of the Basin, the Jurassic Navajo sand, with a thickness of approximately 900 ft, is completely saturated with bitumen. Bituminous limestones in the Phosphoria limestone and minor impregnations in the Weber sandstone of Upper Pennsylvanian Age occur along the north flank of the Uintah Basin.

The total leakage in this Basin, including the gilsonite fissure deposits and the impregnated bitumenous sands, have been variously estimated as representing from 5 to 7 billion barrels of petroleum leakage. Great as this leakage is it should represent only a portion of the unknown and buried petroleum reserves that could occur in the covered interior portions of the Uintah Basin proper.

The most unique characteristic of the Tertiary oils from the Uintah Basin are the high congeal points of the crudes. In the newly discovered Duchesne area the oil is a light straw or tan color with a congeal point of approximately 100 deg. Below this temperature, the oil turns into a straw colored petroleum jelly. In the Ute Tribal area the oil is a dark olive green with a congeal point of 92 deg. This high congeal point is due to the heavy wax and lube content of the oil. The gravities range from 43.1 deg at Duchesne, 33 deg at Ute Tribal, 28 to 29 deg at Red Wash, and 22 deg at Bonanza, with a pourpoint of 55 deg. The handling of such oil will necessitate changes in customary producing and transportation methods. These problems are being worked on and will be taken care of by the producing company engineers and refining technologists.

[1]Spieker, E. M., "Bituminous Sandstones Near Vernal, Utah:" *U. S. Geol. Survey Bull. 822-c*, pp. 77-100, 1930.

The Johnson & Bunn, Watson No. 2 Fee deep test is shown in its setting of the White River Canyon. The photo on next page shows another view.



Older Producing Fields

The petroleum producing areas in this Basin discovered previous to the present oil exploration now underway are the Ashley Valley oil field in Uintah County, Utah, and the Rangely oil field in Rio Blanco County, Colorado.

Rangely is a text-book structure with a strikingly apparent, truncated, closed surface anticline. The discovery well was drilled in 1933 and shut in without any additional development until World War II. The Weber sandstone of Pennsylvanian Age is the chief producing horizon. This sand occurs at a depth of 5500 to 6500 ft with 800 ft of vertical oil producing column in the sand zone. The Weber is a rather permeable sandstone in the northwest portion of the field, but either it is truncated or a facies change occurs in a southeasterly direction. Wells situated in the southeast portion of the field find the Weber very tight and quartzitic. There are 480 producing Weber sand wells in the field, with 5 dry holes outlining the producing margin. Wells drilled to the Weber sand have a spacing pattern of one well to 40 acres. The oil is 34 deg gravity. Average daily pipe line production by unit agreement is sixty thousand barrels per day. Cumulative production to January 1, 1952, is 97,530,000 bbl. Estimated reserves and cumulative production total 275,000,000 bbl. This is now the largest oil field in the Rocky Mountain area.

Exploration of the Ashley Valley structure commenced in 1925 with commercial gas discovered in the Frontier and Morrison sands. Oil was discovered in the Weber sand in 1948. The Weber sand at Ashley has good permeability, and production seems to be controlled by hydrostatic drive. The trap is a faulted anticline with approximately 300 ft of closure and vertical productive oil column. The field is completely developed with a spacing program of one well to 40 acres. There are 29 flowing wells and one pumping well in this field. The daily production by operating agreement is three thousand barrels per day. The oil is trucked to the pipe line at Rangely. Trucking costs are 30 cents per barrel. Cumulative production to January 1, 1952, is 2,503,000 bbl. Cumulative production and estimated reserves total 10,000,000 bbl.

New Discoveries

Generalized information, as now disclosed by drilling in the newly discovered producing areas, follows in the order of discovery.

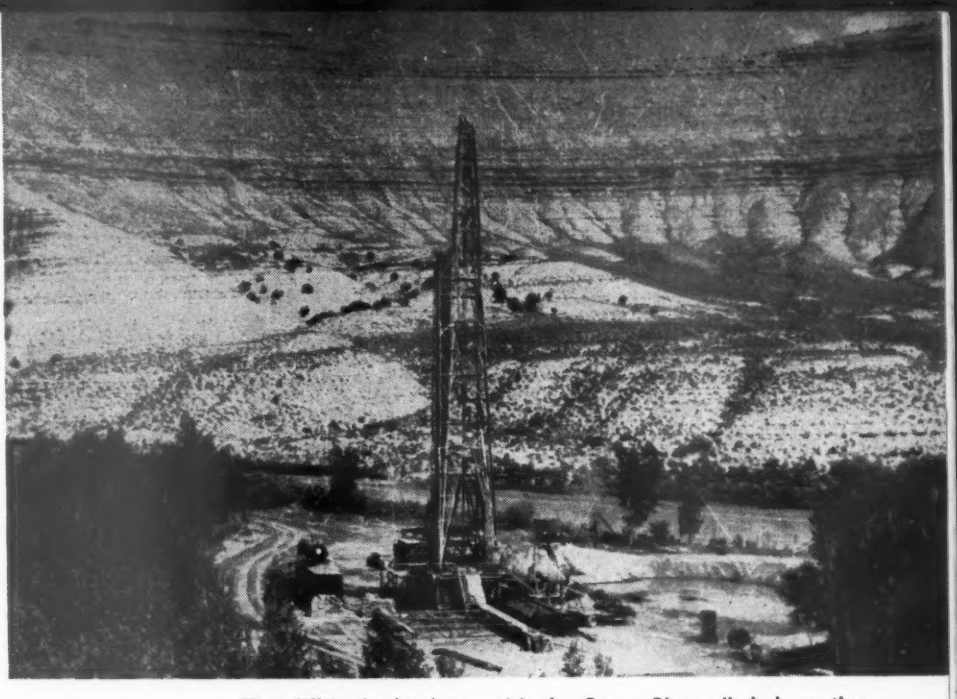
The discovery well of the Roosevelt field was the Carter Oil Company, et al. Ute Tribal No. 1 well, completed June 1949 at a total depth of 9300 ft, producing from fractured basal Green River calcareous shale. The structural trap at this time is uncertain, but drilling to date and seismic data suggest a plung-

ing nose open to the southeast. At the present time there are 4 producing wells and 4 wells drilling on widely spaced locations. The Carter Oil Company is the operator of the unit block and is now drilling three wells. Phillips Petroleum Company has completed one well and Gulf Production Company is now drilling an extension well. The gravity of the oil from the Roosevelt pool is 33 deg, with a pourpoint of 92 deg. Cumulative production from this field is now 540,000 bbl with an average daily production of 800 bbl. The oil is being trucked to Salt Lake City, Utah, at a cost of 55 cents per barrel. The market price of the oil is $2.45 at the well site.

The Red Wash field was discovered by the California Company in their Red Wash No. 1 well, completed January 1951, with an initial production of 250 bbl per day at a total depth of 5360 ft. The producing zone is basal Green River sandstones of Eocene Age. The structural trap at Red Wash is as yet uncertain. Surface mapping suggests that production at Red Wash is probably a strap trap or wedgeout of lower Green River sands on the northwest flank of the conspicuous Hell's Hole-Bonanza plunging arch. Sub-surface correlation from the few wells completed confirm a structural nose plunging to the northwest. This field now covers approximately five sections with at least 50 proved locations to be drilled. This field could extend over considerable area if sand conditions continue favorably laterally. The oil is generally similar to the Roosevelt oil. The gravity is lower however, 28 to 29 deg. with a congeal point of 92 deg. The oil is dark brown in color. As of January 1, 1952, there were 9 widely spaced completed wells at Red Wash, with 5 wells drilling. The daily production was approximately 1000 bbl, with an accumulated production of 95,999 bbl.

The Rabbit Mountain-Hell's Hole gas area was opened by the Johnson, et al, Barrows No. 1 discovery well, completed in June 1951, at a total depth of 2495 ft in the basal Mesaverde sandstone. This well had an initial production of 11,200,000 cu ft of gas per day after a few inches of sand penetration. Two additional wells have been drilled. Barrows No. 2, situated approximately one mile east, and Warner No. 1, situated approximately one mile west, were completed as dry holes. Surface and sub-surface information indicates that accumulation here is controlled by a fault with approximately 100 ft of throw, trending in a northeast-southwest direction, approximately at right angles to the axis of the Hell's Hole-Bonanza structural, plunging nose. Barrows No. 1 well is shut in at the present time.

The Carter Oil Company and Continental Oil Company's Duchesne, Ute Tribal No. 1 well was completed August 1951 with an initial production of 525 bbl per day. This well was completed at a depth of 7500 ft in fractured, calcareous formation of possibly upper Wasatch Age. The structural trap is unknown, but surface mapping suggests a faulted fold, trending in an east-west direction. Two extension wells are now drilling and have encountered possible shallow production at depths of 2943-3012 ft in Duchesne No. 2, and 2668-2706 ft in Willis Moon No. 1 well. These extension wells are situated approximately one mile and 4 miles respectively east of the discovery well. The Duchesne oil is a pale straw color, 42 deg gravity, with a pourpoint of 100 deg. The cumulative production to January 1 was 31,000 bbl. The oil is trucked to Salt Lake City, Utah, with transportation charges of 55 cents per barrel. The present market price of this oil is $2.15-$2.20 at the well site.



The cliff in the background is the Green River oil shale section. The dark streak at about the middle of the cliff is the Mahogany Ledge. Johnson & Bunn No. 2 Fee is in the foreground.

Johnson, et al, completed Watson No. 3 well on December 15, 1951, at a total depth of 923 to 954 ft in a sandstone occurring approximately 160 ft above the base of the Green River formation. This well was drilled with a core rig, using 4½-in. OD pipe set through the sand, and shot opposite the sand. The well filled with oil very similar to the Red Wash oil. The gravity however, was 22 deg with a pourpoint of 55 deg. The formation temperature was 73 deg. This well has not been adequately tested due to heavy snows. The oil flowed to the surface, however, and bailing tests indicated the well should make 5 to 20 bbl when cleaned out and placed on the pump. This discovery is important in demonstrating that commercial oil production can be found at shallow depth in the lower Green River formation.

Geologic Interpretations

No accurate forecast of the petroleum possibilities of the Uintah Basin can be made at this time. The widely scattered wells that have now been drilled to considerable depth over all portions of the Basin, indicate the stratigraphic conditions and the generalized sub-surface structure, however, as far as the Green River formation is concerned. There is little development data as yet that give a true picture of the really great potential horizons of this Basin, namely, production from the Phosphoria limestone, Weber sandstone, and lower Paleozoic horizons.

At this time there are two schools of thought on the potentialities of this Basin. To certain of the operators, the Uintah Basin is a Tertiary problem and their plays have been made largely in the axial portion of the Basin where the Green River formation reaches its maximum thickness and depth, and is more favorable for production. In this general area are situated the new Roosevelt and Duchesne producing areas. Other operators have felt that the truly great production from the Basin will be in the Paleozoic formations and have made their plays on the structural trends where the Phosphoria limestone, Weber sandstone, and lower Paleozoic formations will be found within reach of present drilling equipment. The most prolific fissure leakage and oil sand impregnation, occur in this latter area, particularly along the east and northeast rim portions of the Basin.

Geologists contending that the Tertiary formations offer the best potentialities for prolific production apparently are influenced by the rich oil shale deposits occurring in the upper third portion of the Green River formation. These oil shale deposits have been widely publicized and definitely represent astronomical reserves of shale oil.

According to the U. S. Bureau of Mines Report of Investigations No. 4769, dated February 1951, the oil shale reserves in the Piceance Creek Basin alone, which is in part an eastern extension of the Uintah Basin as here discussed, represents a total shale oil reserve of 619.289 billion barrels. According to this publication, certain portions of the Piceance Basin offer a potential

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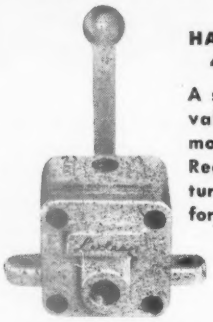

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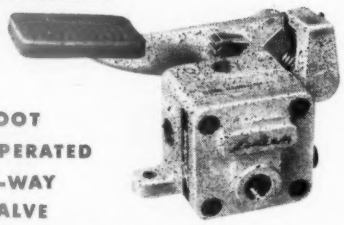

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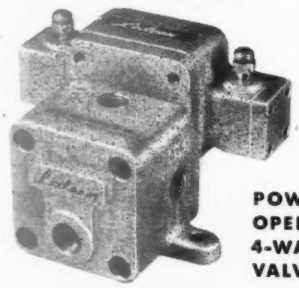

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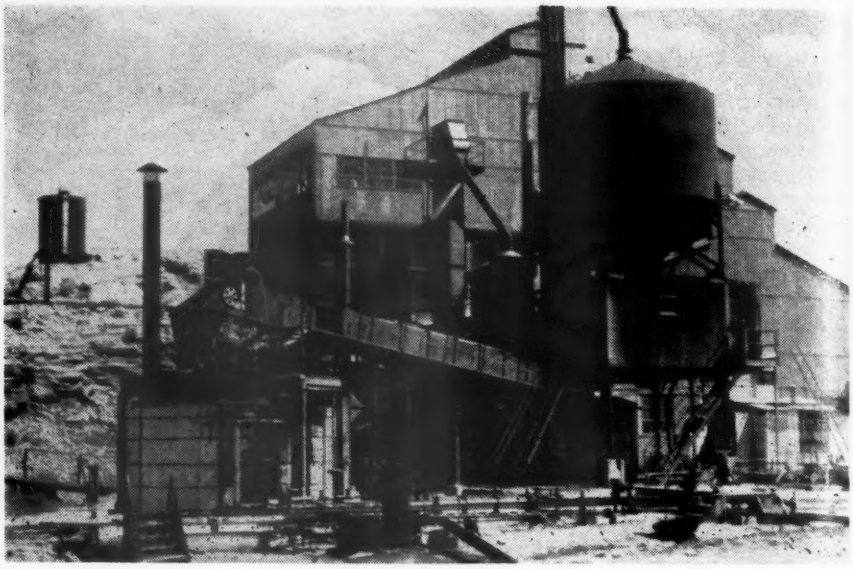


Here is the injection plant of the American Gilsonite Company in which crushed gilsonite is melted and mixed with the oil flow from the Rangely field to Salt Lake City refinery.

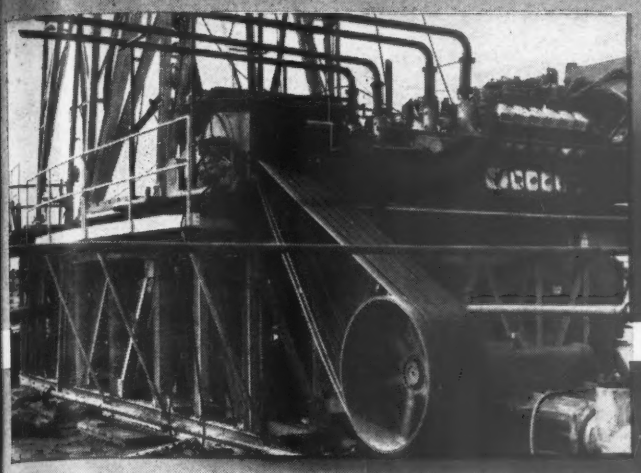
shale oil recovery of 1.9 billion barrels per square mile. Indications are that shale oil reserves in the Uintah Basin will probably be greater than the reserves in the related and smaller Piceance Creek Basin.

The Green River oil shale, as represented in its richest development by the Mahogany Ledge, occurs in the upper portion of the Green River formation. Along the outcrop, at the eastern rim of the Basin, the top of the Mahogany Section occurs from 450 to 500 ft below the top of the Green River formation and has a thickness of from 30 to 60 ft. As the deeper portion of the Basin is approached, the interval below the top of the Green River formation and the Mahogany Section increases, and the thickness and richness of this stratigraphic unit increases likewise. The Mahogany Section, both on its outcrop and in cores obtained from wells drilled deeper in the Basin will retort 20 to over 50 gal of shale oil per ton of shale.

On the eastern outcrop and as far downdip at the Red Wash oil field, the lower Green River formation is decidedly different lithologically from the upper Green River oil shale horizons. The shales in the lower Green River, generally speaking, are lighter colored, more clay like and bentonitic, and occur with oolitic, ostracodal and algal limestone stringers. This portion of the Green River formation is also generally more sandy, with occasionally some rather well developed sandstones. In the Rabbit Mountain area, the lower Green River builds up into algal reef limestones of considerable thickness suggesting a marine phase.

The richness of the Mahogany Section along the outcrop does not seem to vary as to local structural position. In general the thickness and richness of the kerogenous material in the shale increases as the deeper portion of the

Below are piles of gilsonite mined from the Bonanza fissure awaiting transportation to the injection plant.



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Uintah Basin

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It is this writer's present opinion that actual facts disclosed by drilling in the Uintah Basin to date do not support the idea that the oil shale section in the upper Green River formation has been the source of any petroleum so far produced in the Basin. All commercial production has been obtained from horizons below the oil shale zones of the upper Green River. This includes production at Roosevelt, Red Wash, Duchesne, and the shallow discovery in the Bonanza area. In all these areas the actual petroleum production occurs in the basal portion of the Green River formation from 1300 to 3000 ft stratigraphically below the rich oil shale beds. All known methods of obtaining shale oil from the source rock calls for thermal distillation and combustion of the oil shale. There is no evidence of any great metamorphism in the upper Green River oil shales in this area.

The fractured conditions at Roosevelt and Duchesne suggest the possibility that the oil now being produced could be connected with deeper and more favorable reservoirs. There is evidence, however, that certain of the oil seepages and tar sands observed on the outcrop of the lower Green River formation are indigenous to the horizons in which they occur. This could be the case at both Roosevelt and Duchesne; if so, the Tertiary reserves are limited in these areas on account of poor reservoir rock.

Interpretation of Fissure Leakage

The true answer as to the oil and gas potentialities of the Uintah Basin probably lie in the correct interpretation regarding the source of the gilsonite in the fissure deposits, particularly those in the Bonanza-Hell's Hole and Rainbow-Dragon areas. Here are the greatest known fissure leakage of hydrocarbons in the world. This leakage definitely amounts to hundreds of millions of barrels and possibly billions of barrels of what was formerly petroleum. Inasmuch as these gilsonite fissures seem to occur as tension fractures along the axis of low, plunging folds, the correct determination of the source of these enormous deposits is very important. as these fissure deposits could represent leakage from immense reservoirs of petroleum at considerable depth, which are still unknown and untested.

In most of the previously published articles and reports concerning the gilsonite deposits in the Uintah Basin, the source of the gilsonite has been considered to be the Green River oil shales, particularly the Mahogany Ledge. These conclusions are based on the fact that many of the conspicuous gilsonite fissures cut the surface in the overlying Uintah formation, with the rich oil shales undercover and below the surface exposure of the fissure. These conclusions have been augmented by the fact that the gilsonite has many superficial characteristics of shale oil when melted. While these conclusions are logical, they are not supported by field evidence and

close investigation in the Bonanza and Rainbow areas.

The fundamental weakness of this conclusion is the fact that a reservoir, and a tremendous reservoir, of liquid hydrocarbons had to exist under the fractured area, previous to the formation of the vertical earth fissures now filled with gilsonite. No such reservoirs or reservoir rocks, depleted or otherwise, have been found on the outcrop; or by drilling, either in or associated with, or adjacent to, the Mahogany oil shale section. This oil shale section, wherever it can be observed on the outcrop or in well samples, seems very uniform and unaltered in character. It is universally hard and tough, absolutely impermeable and dense. In fact, in toughness and permeability it resembles a very dense, hard-wood, hence, its name. Cuttings from this oil shale section will give only a slight petroleum cut in ordinary petroleum solvents and will not fluoresce.

From close observation and study it would seem physically impossible for the tremendous volume of liquid hydrocarbons that have filled fissures the magnitude of the Cowboy, Bonanza and Rainbow veins, to have been generated and forced into these fissures, from the oil shale section, in the short space of time that these fissures were opening. Field evidence indicates that as the vertical fissures opened, a viscous, hydrocarbon liquid, under great pressure filled them. This viscous liquid apparently rose upward under such pressure, that thin shale beds, on the fissure walls in some instances are folded upward. Likewise, occurrences are known in certain gilsonite fissures, where pieces of wall rock, weighing several thousand pounds and as large as a jeep, have been carried upward by the viscous flow. There are numerous instances of the liquid hydrocarbon penetrating and locally enriching permeable sandstones cut by the fissure. The penetration into such sands has ranged from a few inches to several feet, depending on the permeability of the sand and the viscosity of the liquid at the time it was rising in the fissure. No occurrence has been found by this writer where the liquid gilsonite has emanated from the wall formation to fill the fissure. Every observation seen has indicated the reverse.

The Dragon and Colorado gilsonite fissures cut the upper Wasatch formation and actually terminate upward before reaching the Mahogany Marker. The Dragon gilsonite fissure on its western extremity closes upward, passing into vertical fractures, which continue upward to the Mahogany Ledge. These fractures are barren of gilsonite, both below and where they cut the rich oil shales of the Mahogany Ledge. Certainly the gilsonite in the Dragon fissure originated below the Green River oil shales. Also, the Colorado gilsonite fissure, which is situated farther updip than any fissure in the Bonanza area, cuts surface formations that occur stratigraphically 400 to 1600 ft below

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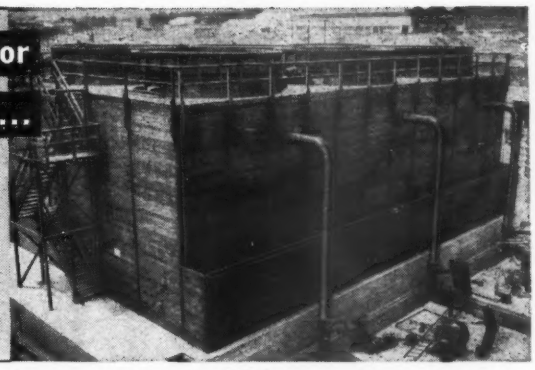

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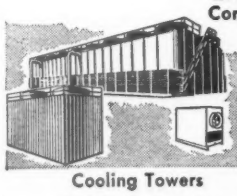

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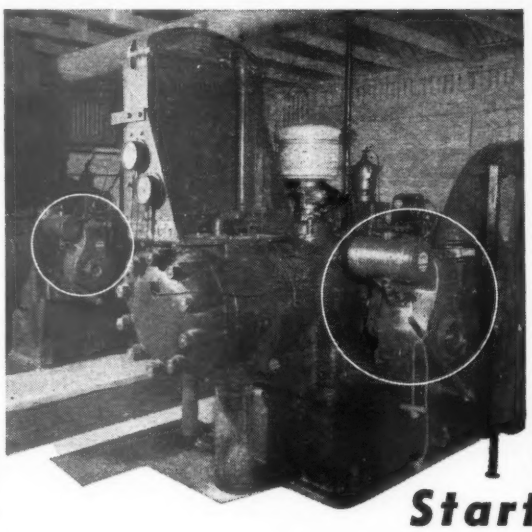

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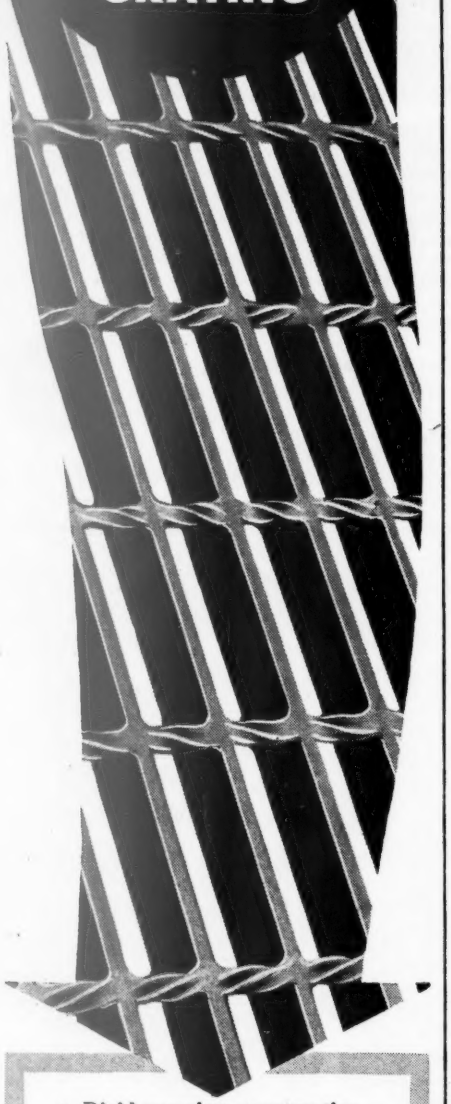

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the Mahogany Ledge. At its updip termination the Colorado fissure cuts beds stratigraphically 400 ft below the top of the Wasatch formation.

Significance of Deep Bonanza Test

Johnson, et al, Watson No. 2 well, situated in the Bonanza area, commenced drilling approximately 450 ft stratigraphically below the base of the Mahogany Ledge and drilled to a depth of 9504 ft. No reservoir rocks capable of supplying the volume of hydrocarbon needed to fill the Bonanza and Colorado veins were penetrated to this depth. Thin sandstones occurring in the base of the Green River formation at a depth of 960 to 980 ft and 1000 to 1020 ft carried oil somewhat similar to Red Wash, but of lower gravity. The Wasatch sands penetrated in this well were silty and carried gas. The Mesaverde sands penetrated from 2230 to 4260 ft were even more silty and carried varying amounts of petroleum gas, non-inflammable gas, and in some instances, distillate. The Dakota sand, at a depth of 8745 ft, gave a strong blow on drill stem test of odorless, non-inflammable gas. Gilsonite and tar were noted in the cuttings at various depths to the bottom of this well at 9504 ft. These shows apparently occurred in fractures. In a total of 20 drill stem tests taken from 3090 to 9193 ft, no trace of water of any kind was recovered. Apparently then to a depth of 9504 ft, and to the Curtis formation of Jurassic Age, no reservoir capable of supplying the gilsonite in the Bonanza area has yet been found, and the source reservoir is apparently still deeper.

At Rangely streaks of gilsonite and gilsonite sludge have been observed in cores from the Weber sand, and gilsonite sludge is occasionally formed in the stock tanks during the course of well production. In the Johnson, et al, Neal State No. 2, located three miles northwest of the Ashley Valley oil field, the Phosphoria limestone, with a thickness of 170 ft, was cored continuously with a diamond core bit. This limestone was rather tight and impervious, but certain zones were vuggy and fractured. In all instances these slightly permeable zones and fractures were saturated with a crude petroleum that congealed at rather high temperatures and appeared to be quite similar to the oil produced at Red Wash. In the lower portion of the Phosphoria lime section in this well, a few inches of limestone, having vuggs up to ½ in. in diameter were penetrated. These vuggs were filled with a jelly-like bitumen, which, after a comparatively short time of exposure to the atmosphere, solidified and formed a solid hydrocarbon similar to the gilsonite of the fissured area. The bitumen in this core appeared to be indigenous to the Phosphoria lime in which it was found. This is concrete evidence that gilsonite could and does occur in formations as old as Permian.

Inasmuch as the most prolific actual reservoir rock now producing at Rangely is the Weber sandstone, and to a much lesser extent the Phosphoria lime at Ashley Valley, these horizons could be the reservoir rocks in the Bonanza, Hell's Hole and Rainbow areas from which the gilsonite was derived. The Weber standstone, with a thickness of 1200 ft and good permeability, as exposed on the surface outcrop in Split Mountain canyon, would certainly be an ideal reservoir.

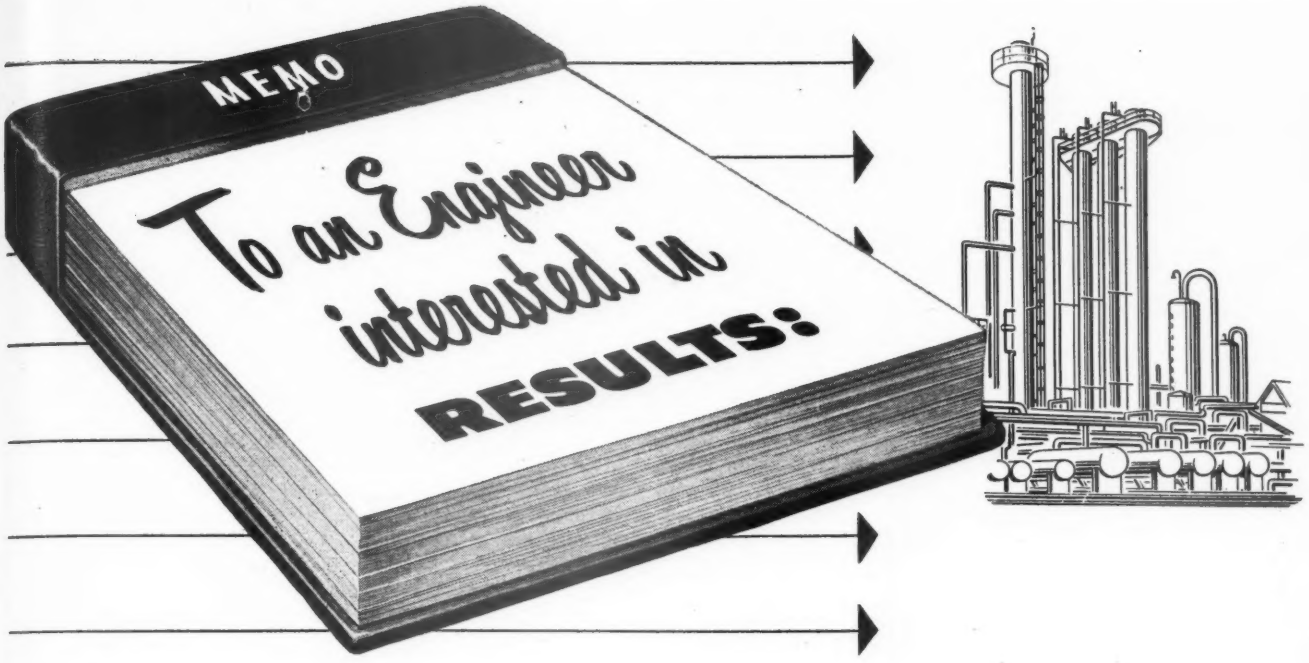
Stratigraphic Traps in Paleozoic Rocks

Regional surface and sub-surface study tends to indicate a permeability line trending in a southwest-northeast direction from the southeast end of the Rangely Oil field across the eastern portion of the Uintah Basin. The Phosphoria limestone, likewise, is non-existent east of this approximate lime, but appears to thicken quite rapidly in a northwesterly direction into the deeper portion of the Uintah Basin. Thus, there appear to be at least 2 potential strap traps in the upper Paleozoics of this area. Since the general trend of the Basin axis and the paralleling, low, plunging folds are generally slightly northwest and southeast, there are potential oil or gas traps set up wherever these permeability lines cross the axis of a plunging fold. It is of interest to note that no gilsonite veins are known to occur in the Uintah Basin, as here outlined, east of this approximate permeability line in the Weber sand.

Transverse Faults

It has been demonstrated by the drilling in the Hell's Hole area, that transverse faults could play an important part in the accumulation of oil and gas in the eastern part of the Basin. Detailed surface mapping has located and pinned down at least 5 faults with throws of 100 to 180 ft, cutting across the axis of the plainly discernible Hell's Hole-Bonanza structural trend. Unfortunately these faults cut only the lower 250 ft of the Green River formation and are blanked out upward. They appear to increase with depth and could conceivably pass into throws of considerable magnitude in the Paleozoic rocks. It now appears from the drilling done in the Hell's Hole area, that each fault could be an individual potential oil and gas trap. Whether or not these faults cut the lower formations is as yet unknown. but magnetic profiles indicate that these faults reach the basement.

If the above conclusions are correct, it is quite apparent that the real potentialities of the Uintah Basin will be in the Permian and lower Paleozoic formations, and that the wells now being drilled in the tertiary portions of the Basin, while deep, are mere post holes stratigraphically. It is further believed that oil production from the fractured reservoirs and thin sands now being developed in Tertiary beds, regardless of the ultimate outcome, will be mediocre compared to oil and gas accumulation that should exist in the Paleozoic rocks under favorable traps in this Basin. ★



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The Dianodic Method consists of employing a *combination* of two anodic inhibitors under proper conditions of concentration and pH in such a manner as to produce results that are outstanding. For instance:

A southwestern recirculating cooling water system was plagued with severe corrosion throughout the entire system. Of particular concern was the severity of the pitting and the large tubercles found in the lines. Actually, tuberculation in some of the 8-inch lines was so bad as to practically obstruct all flow. And, accumulations of iron oxide in the heads and channel boxes of some units caused excessively high manual cleaning costs.

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The Dianodic Method is just one of many advanced developments produced by Betz Laboratories. It is the result of sound engineering and progressive research in water conditioning for over a quarter of a century. Call in a Betz Engineer today. Let him show you how you can obtain *results* in your plant. You'll be glad you did. W. H. & L. D. BETZ, Gillingham & Worth Streets, Philadelphia 24, Pa. In Canada: Betz Laboratories Limited, Montreal 1.

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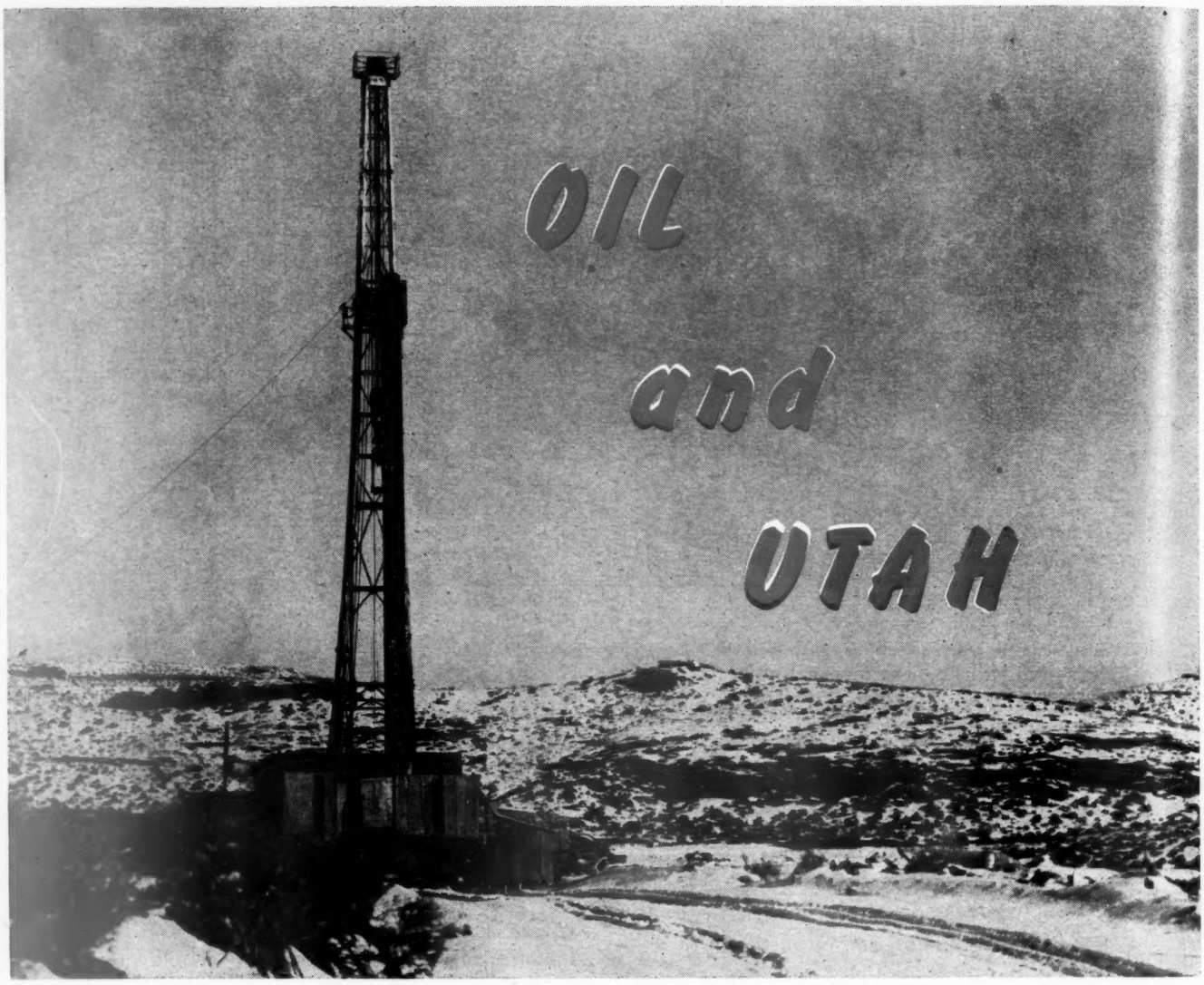


Roads to the isolated wells in the Uintah Basin frequently disappear into the snow drifts isolating drilling crews for several days at a time. This Carter wildcat in the Willow Creek area depends on bulldozers to supply water and fuel most of the winter.

J. R. McWILLIAMS*

THOUSANDS of persons heard of Vernal, Utah, about three years ago when three churches—representing an expenditure of about $1,000,000—were dedicated on the same day. The town has a new half-million dollar hospital, the museum here is a showplace for the multitudes.

Uintah County leads the state in livestock production. Forty per cent of the county's income is from sheep. Population has increased to about 3700, and there are more than 100 new houses than there were this time in 1951.

Here is the Uintah Basin with its rich store of mineral resources.

Utah has been in the mineral spotlight of this nation for a hundred years. About one-fourth of the nation's copper comes from this state. It had natural gas 60 years ago. There are some 210 known minerals recovered for man's use in the state. In total value of mineral production, Utah ranks high second in the nation.

In the past 80 years the mountain ranges and valleys and rugged terrain of Utah have yielded basic and precious metals valued in excess of two billion dollars.

Now, petroleum bids for an opportunity to join other growing and established industries in building for the future. Oil was first discovered in 1908 in southeastern Utah, in the San Juan country, but it was 40 years later before prospecting brought in the Ashley Valley field. Since then there has been an intensive search for additional fields, and important development of the state's petroleum resources has begun.

Figures do some sound talking.

In 1949, the total oil production in the state was 640,000 bbl.

Last year, in 1951, thanks to new oil development near Vernal, more than 1,310,000 bbl of oil were recovered—a 100 per cent jump. That is all the more impressive when you realize how last year's production compares with the 1,800,000 bbl of oil that represents Utah's all time total recoveries up to January 1 of 1951!

There are 30 wells in the Ashley Valley field producing about 2600 bbl daily. The Duchesne discovery is making about 90 bbl daily, the 9 wells at Red Wash are doing some 1300 bbl daily, and the wells in the Roosevelt field are returning 530 bbl daily.

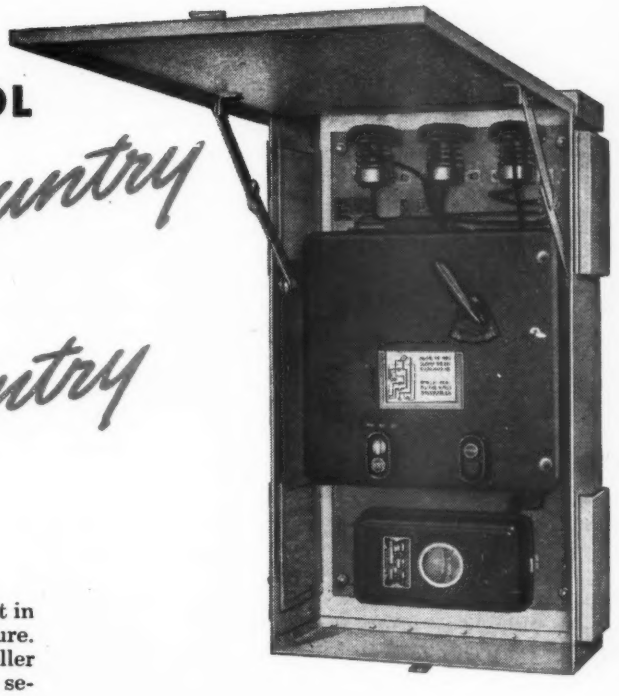
Thirty-nine wells were completed in Utah last year, but—29 of these were dry. These 29 dry holes represent a big investment with no return. From $6,000,000 to $10,000,000 sunk in the ground—illustrative of the capital required in the oil business today. It's not all profit—it takes a lot of trial and error and time and effort to find what we're looking for.

Let's look at the oil finding efforts

*Vice president, The Carter Oil Company. This article is condensed from a speech made at Vernal, Utah, January 30, 1952.

CUTLER-HAMMER

OIL WELL PUMPING CONTROL



designed in the oil country

built for the oil country

Cutler-Hammer went into the oil country to design its oil well pumping control. The thoroughness of its research is shown by the outstanding performance and preference for this controller.

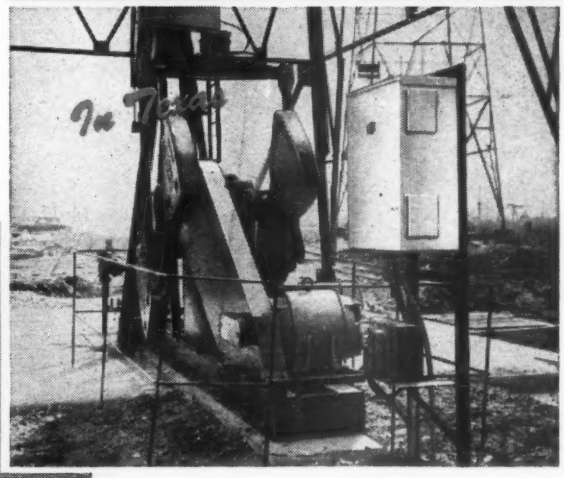
Cool operation. Intelligent ventilation, sound construction, proper design of overload heater coils, aluminum painted enclosures keep this controller *cool*. You never see a C-H Controller with its door propped open to keep it working.

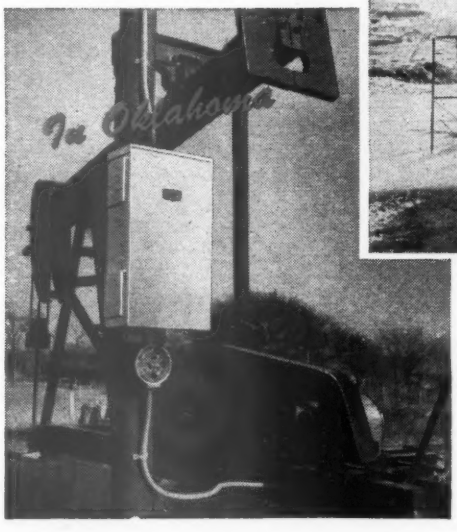
Dependable performance in dust-laden air. Triple protected ventilation openings, Cutler-Hammer's exclusive vertical dustsafe contacts, a neoprene-gasketed dustproof enclosed timer and a timer clock motor with excess torque keep this controller working

Automatic staggered restarting. Although the Cutler-Hammer Controller is available *without* undervoltage relay, and *with* undervoltage relay, the most popular type has automatic restarting on a staggered schedule. Attendant doesn't have to go out in the storm after a power failure. He knows the C-H Controller will start up motors in proper sequence after such voltage failures.

Other features. Lightning arresters are the unit type. Should one blow, that fact is revealed at a glance. And you don't have to virtually rebuild the starter. Changes in pumping sequence are made in definite 15 minute increments just by pulling small accessible tabs. Resetting of clock after stoppages is made simply by turning a handy palm-size dial forward or backward. Wiring diagram, spare parts list and overload heater coil ratings are printed on a plastic-coated, dirt, grease, heat and moisture repellent sheet enclosed in each starter case.

There's dependability, ruggedness and performance plus in these Cutler-Hammer Oil Well Pump Controls. CUTLER-HAMMER, Inc., 1459 St. Paul Ave., Milwaukee 1, Wis. *Associate:* Canadian Cutler-Hammer, Ltd., Toronto, Ontario.

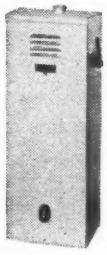


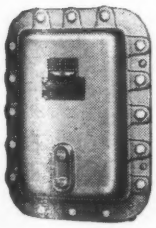


OTHER CUTLER-HAMMER PRODUCTS FOR THE INDUSTRY

Bulletin 9589
Combination Starter

Across the line starter for squirrel cage motors, with side operated knife blade type disconnect switch combined in same special service enclosure. Completely wired. Saves time of installing two separate items.





Bulletin 9739
Across the Line Starter

For use with two speed consequent pole type polyphase squirrel cage motors. Form 1, selective, for pushbutton or automatic pilot device. NEMA 7 enclosure for hazardous locations.

CUTLER-HAMMER
MOTOR CONTROL
C-H

and how they have zoomed in Utah. Last year there were the equivalent of 95 crew months of seismograph work. It costs about $15,000 per month to operate a seismograph crew. The total cost was $1,425,000. The 95 crew months are comparable to operation of a crew every working day for 8 years. Today, in areas all over Utah, these skilled men are working to tap nature's pulse in the hope of finding conditions favorable for petroleum.

Some great sums have already been spent for bonus and rentals on leases on fee, state, Indian and Federal lands. Several millions of dollars have been spent on geological and geophysical work and wildcat drilling. Many more millions will be invested in the future. Costs of drilling a well vary, but the deeper ones range from $250,000 to $500,000.

At the present time Carter Oil Company has 8 wells drilling in Utah. For all industry, it is a good guess that some 70 to 90 wells will be drilled this year in the Uintah Basin. The number of wells that probably will be drilled in Utah this year, divided about evenly between wildcat and development wells, will double the 39 wells completed last year.

Utah's oil progress is watched with interest because, with the demand for crude oil and products mounting year by year, the nation looks for new supplies and new outputs to help meet this need. An overall picture of the petroleum industry, as of today, in the United States shows that:

Last year, 44,516 wells were completed in this country, an all time record. This year, it is estimated that 45,446 wells will be completed and the total footage drilled may reach 179,500,000 ft.

Total daily production of oil in the United States in 1951 was 6,144,000 bbl daily. This year, daily production will be increased an estimated 4.7 per cent.

In Utah, forecasters predict that the increase in daily production will exceed the anticipated national average increase of 4.7 per cent with transportation of crude oil being one determining factor in how great the increase in production will be.

The daily demand for crude in this country last year was 7,467,000 bbl daily, an increase of 9.8 per cent over 1950. Because we have an additional 557,000 bbl coming from natural gas cycling plants and imports of about 848,000 bbl daily, the daily available supply still exceeds the demand.

The demand this year is expected to reach 7,939,000 bbl daily. This figure is staggering when you realize that it represents an increase of 71 per cent in the last 10 years.

Based on construction and expansion programs announced or already under way, the daily capacity of U. S. refineries in 1952 will reach 7,360,000 bbl.

Crude oil and products and natural gas have to move, and there are at present some 310,000 miles of pipe lines in this country, including crude oil and product lines and gas transmission lines. There are 160,000 miles of pipe lines handling crude and products.

I think it noteworthy that since the end of World War II, the industry in this country has made a total capital expenditure of about $15 billion, plowing money back into the business to meet an ever growing need. In the first years after cessation of hostilities in World War II, the demand did not fall off abruptly as some anticipated, but rather—with a short breathing period for adjustments—domestic usage soared and soon far outdistanced the highest figures for the war years. The need for more petroleum has been increasing since that time.

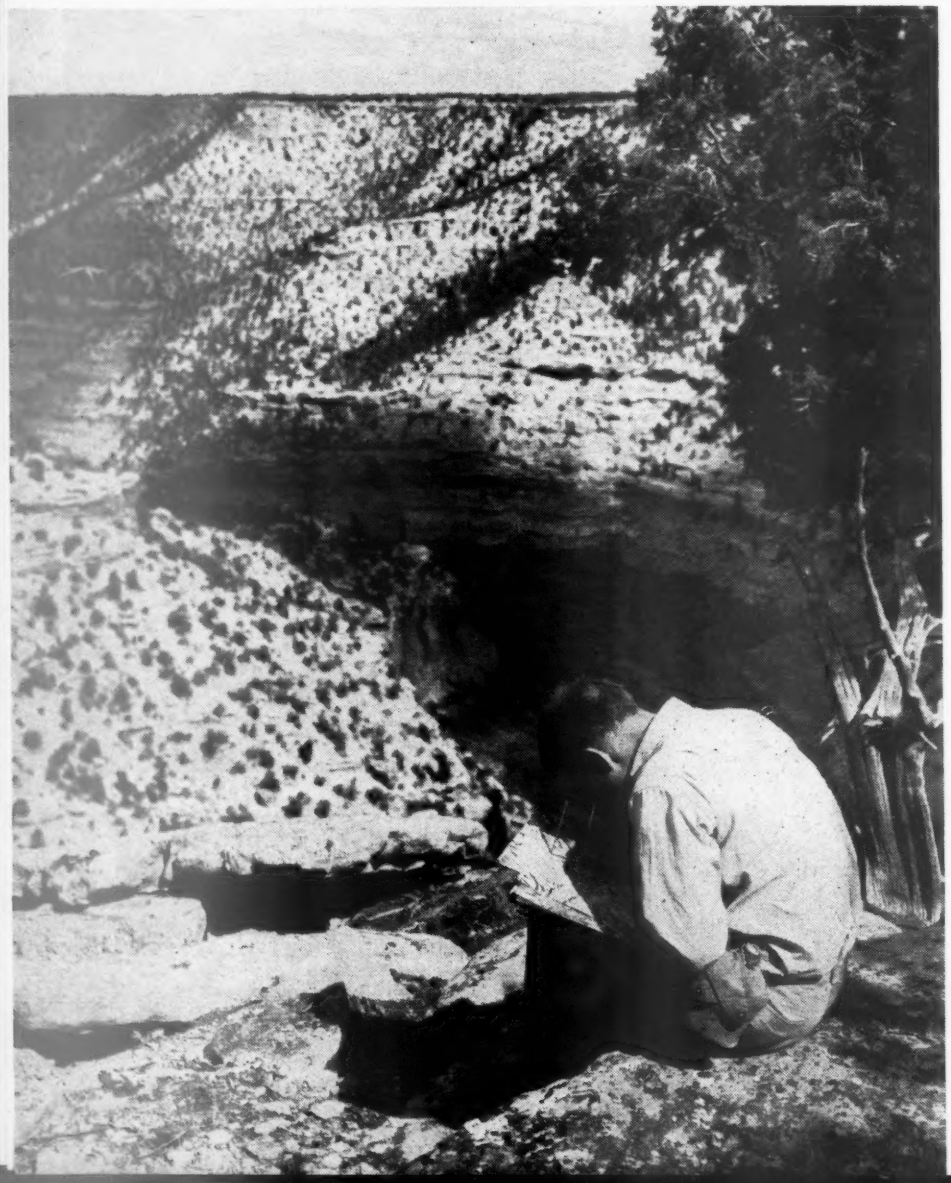
Current development in Utah could not have come at a better time.

As I see it, the further growth of the oil industry in Utah will depend, to a great extent, upon (1) the degree of success attending a continued and diligent search for oil, utilizing the most modern and adaptable exploration equipment and methods available, and (2) practicing the most efficient development and production methods possible.

Once an oil reservoir has been found, the methods used to develop it and to produce the oil from it should be those that will permit the recovery of every barrel of oil it is possible to recover economically. This is true conservation, but effectuating it is no simple matter because of the varied and often conflicting interest involved.

For the first 65 or 70 years after the discovery of oil—a little more than 92 years ago—the discovery of a new oil field resulted in a mad rush to drill as many wells as rapidly as possible. These wells were produced "wide open" if they would flow, or were pumped to the capacity of the pumping equipment. The driving motive behind each lease owner was to get as much oil as he could and as quickly as possible. This naturally resulted in what was later recognized as a most reckless waste of an irreplaceable natural resource. A large percentage of the oil remained underground, millions of cubic feet of gas were blown into the air and wasted, and there was also an indeterminate loss of oil on the surface—around the wells, in earth pits,

The Willow Creek area of the Uintah Basin in Utah is a desolate series of sudden canyons and sharp rocks strewn with sagebrush. Here a Carter Oil Company geologist who is one partner of a matched altimeter team checks over his work.



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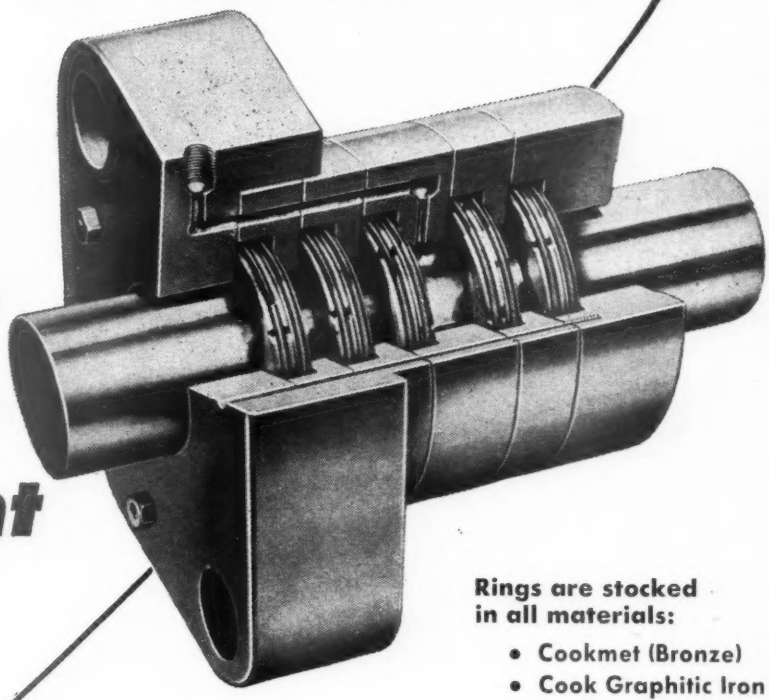

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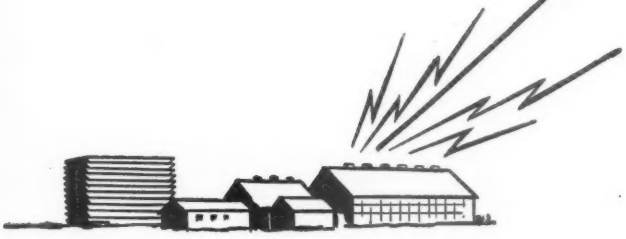

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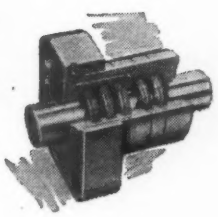


. . . SEALING PRESSURES SINCE 1888 . . .

Heavy wind-shields and lots of heating equipment are necessary to keep this Carter rig drilling the No. 2 Duchesne-Ute Tribal well in the Uintah Basin. Sub-zero temperatures and whirling snow blizzards pound this exposed plateau throughout the winter.

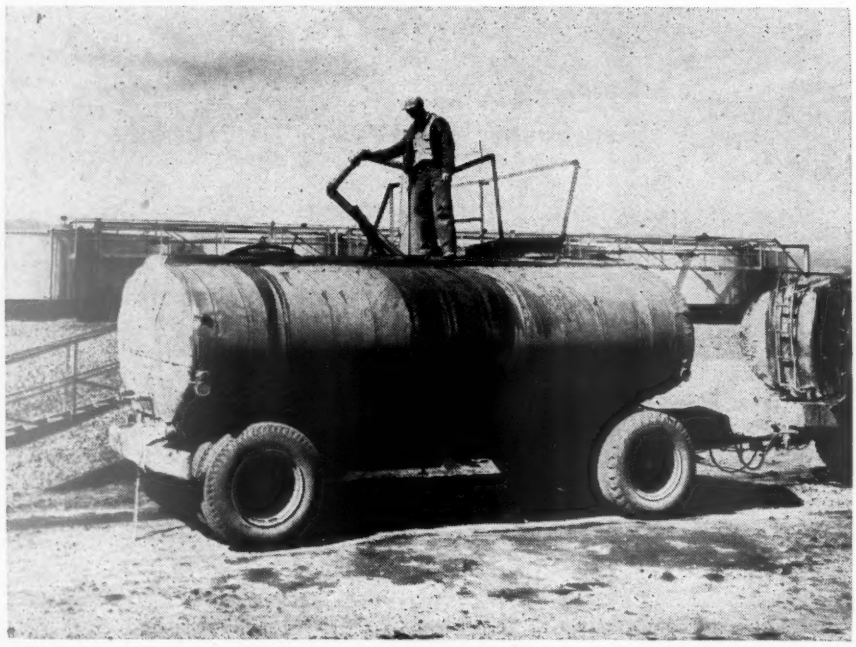
around tanks, etc., and millions of dollars were spent in drilling and equipping unnecessary wells.

It was assumed that this method of developing and producing recovered *all* the oil there was in a given "pool" or field. But later on, it was discovered by drilling new wells in some old, depleted pools and analyzing cores of the reservoir rock that from 60 to 80 per cent of the original oil was still there — "dead"—and only 20 to 40 per cent has been produced. This waste — underground waste—was the greatest waste of all, though not visible. Today some of this oil is being recovered through secondary recovery methods on a profitable basis but with added costs.

The visible waste of oil and gas, the chaotic conditions prevailing, and the threat of an inadequate supply of oil for domestic and military use shortly after World War I prompted the Federal Government and some of the state authorities to seek some equitable means of reducing this waste, and of encouraging the building up of more adequate reserves. In the meantime, the legal profession and the courts had become interested in the principles of property rights involved in developing and producing oil properties, and based on the meager facts at hand concerning the nature and behavior of oil, some fundamental laws were established. With this as a background, some of the states passed laws calling for regular and orderly spacing of wells and the prohibition of wasteful producing practices. This tended to reduce waste and to protect the rights of the various owners to the oil under their land. With order established, industry leaders and universities became interested in the study of oil and gas reservoirs. Courses in petroleum engineering were established, and petroleum engineers began gathering, organizing, and analyzing factual data, such as effect of well spacing, gas-oil ratios, reservoir pressures, effect of producing rates on reservoir pressures, calculating from cores the approximate amount of oil in each acre-foot of reservoir rock, and in the entire pool, determining the type of reservoir, most efficient method of drilling and producing to secure maximum recovery of oil, etc.

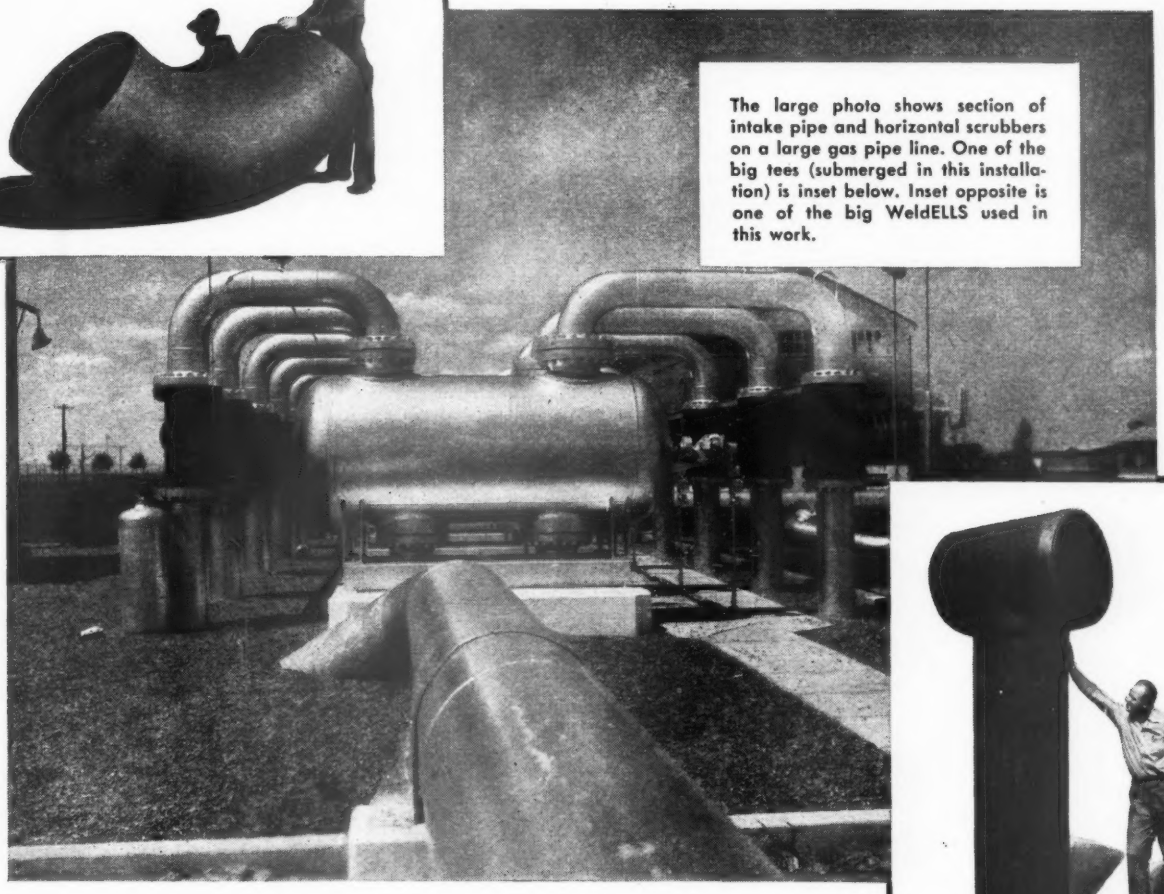
Out of these studies evolved the fact that any given pool represents a common source of supply of oil and that it is impossible for any owner to produce only the amount of oil under his land

High pour point oil discovered by Carter in the Uintah Basin near Roosevelt, Utah must be heated before being placed in these insulated tank trucks for transportation to the refinery.



PHOTOGRAPHS ARE BY COURTESY OF THE CARTER OIL COMPANY.

The large photo shows section of intake pipe and horizontal scrubbers on a large gas pipe line. One of the big tees (submerged in this installation) is inset below. Inset opposite is one of the big WeldELLS used in this work.



GUESS-WORK WON'T GO ON THE PIPE LINES

As the demand for oil and gas mounted, the pipe lines grew. The first growth was in number and miles; then in size and pressure. The use of larger pipe lines under higher pressure has hurled a challenge at the pipe designer. To hold down costs he must press further toward the yield point of pipe line materials . . . but never too near the danger point. Sound engineering is indeed required to insure safe operation under loadings that stress materials at 65% to 85% of their yield strength. There is no "margin for ignorance" here. You must *know!*

Recent Taylor Forge contributions to the pipe lines include improved designs of WeldELLS in large sizes and tees giving greater safety at branch connections... produced in materials whose strength matches or exceeds that of the tough API5LX pipe now being used in transmission lines.

Ask for the facts about the WeldELL line of welding fittings and Taylor Forged Steel Flanges.

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Oil discovered at the No. 1 Duchesne-Ute Tribal wildcat well by Carter has such a high pourpoint that at normal temperatures it congeals to a butter-colored grease. This well was Carter's second discovery in the Uintah Basin and is located about five miles from Duchesne, Utah.

Uintah Basin

without affecting the rights of his neighbors. But of far greater importance was the discovery by petroleum engineers that a reservoir also contained a common source of energy without which oil could not be pushed through the pore spaces, the cracks, and fissures of rocks to the well bore. This energy is pressure —water or gas—and cannot be divided and allocated to the various leases. Once this energy has been wasted the field becomes dead, for oil cannot move itself through the rocks—it must be pushed. Hence, to recover the maximum amount of oil from a reservoir, the pressure or energy must be maintained by control of producing rates, and/or by forcing gas or water back into the reservoir.

This concept of a common source of supply of oil and of reservoir energy constitutes the greatest advance yet made in oil and gas conservation, and forward-looking lawmakers are providing the legal means with which it can be accomplished. Nearly all the oil-producing states have adopted comprehensive oil and gas conservation statutes and have set up commissions to make and administer rules and regulations which will make the statutes effective. Wyoming and Colorado adopted such statutes last year. Among other things, these statutes authorize unit operations, on a voluntary or cooperative basis, not only of a drilling unit, but also any part or all of a pool. Two states—Oklahoma and Arkansas—have passed laws that give their respective commissions power to order the unitizations of entire pools after certain percentages of the lease and mineral owners have agreed among themselves that such a course is desirable.

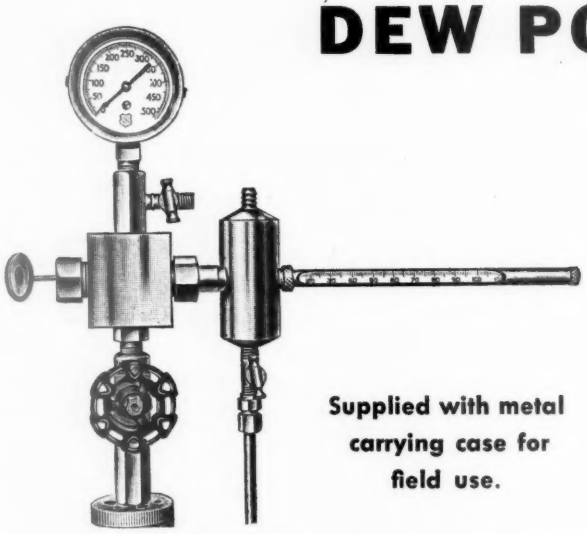
Many successful unit operations are located in the Rocky Mountain area. The Elk Basin and Salt Creek pools in Wyoming are examples. But of even greater interest to you is the unitization of the Roosevelt pool in the Uintah Basin. This ambitious program covers some 35,000 acres. The plan has already been approved by almost all of the lease owners, by the State of Utah, by the Tribal Council of the Utes, and by the Director of the United States Geological Survey. Such a cooperative plan, entered into by industry, by individual citizens, and by state and federal agencies represents conservation in its broadest and truest sense.

Developing wells and increasing overall production may seem like a slow process to the outsider. But in retrospect, it is a fast moving program that jumps the state's daily production from about 800 bbl daily to 3600 bbl daily in a three-year span—particularly at the great depths wells must be drilled in this area.

It seems to me that you can appraise the future of the oil business in Utah with assurance, and see the present oil development as indicative of vital, substantial, lasting growth. * * *

DEW POINT TESTER

For Gas Under High Pressure—



Supplied with metal carrying case for field use.

No. 8485 DEW-POINT TESTER, Bureau of Mines Types, is designed for convenient and accurate determination of the dew-point of gases at actual flow pressures. Recommended for pressures from atmospheric to 3000 psi. Tests show that measurement can be duplicated to 0.2° F. Standard instrument is calibrated for 1000 psi with thermometer reading from –30 to 110° F. Testers for other ranges of pressure and temperature are available. Constructed of stainless steel and copper.

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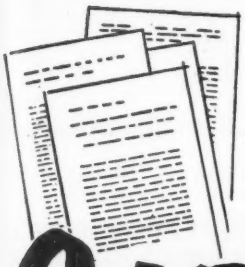


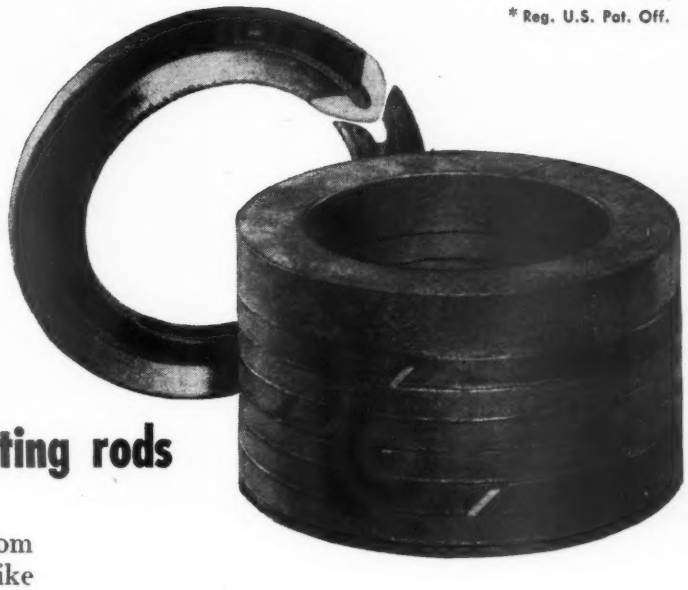
Service Reports Show that

GARLOCK CHEVRON*

* Reg. U.S. Pat. Off.

SEALS BETTER, LASTS LONGER

than ordinary V-type packings on rams, plungers and reciprocating rods



GARLOCK CHEVRON Packing is entirely different from an ordinary V-type packing. Its distinctive hinge-like construction provides greater flexibility without loss of strength and results in a quicker, positive automatic sealing action.

With increasing pressures Chevron rings tighten and prevent leakage; with decreasing pressures the packing eases off and permits operation with a minimum of friction.

Service reports, such as those at the right, prove that Chevron seals better, needs less maintenance, and lasts longer.

For general applications specify 430 CHEVRON for cold and warm water service; 431 CHEVRON for cold and warm oil; 530 CHEVRON for steam, air or gas; 531 CHEVRON for hot oil. For special applications GARLOCK CHEVRON is made of "Teflon" and other special materials.

Typical CHEVRON Service Reports:

- Oil hydraulic presses packed with ordinary V-type packing. Due to oil seepage down ram special hoods had to be installed to protect operators. Installed all-synthetic rubber type Chevron alternated with Garlock Bitan V leathers. Result-rams are perfectly dry and protective hoods have been removed.
- Boiler feed pump in state institution. Operates average of 6 hours per day—365 days per year pumping water at 212-220 deg. F., 170 psi, discharge, 15 ft. head positive suction. Packed with Garlock 430 Chevron in 1942. Packing still operating efficiently.
- Reciprocating pumps in pipe line pumping stations. Pressures up to 700 psi. Stuffing boxes bushed to shallower depth as only four Chevron packing rings required to handle work performed previously by a much greater number of ordinary packing rings. Maintenance men very pleased with long life of Chevron packing and particularly lack of need for gland adjustment for changes of gravity in the crude oil being pumped.

THE GARLOCK PACKING COMPANY
PALMYRA, NEW YORK
Tulsa, Okla. Houston, Tex.
Los Angeles, Calif.

GARLOCK PACKINGS, GASKETS, OIL SEALS, MECHANICAL SEALS

PETROLEUM PROFILE

ROBERT M. CHAN is one of Magnolia's vice presidents without portfolio, but he has a mighty big brief case to carry around. A sort of financial "Mr. Fixit," his long experience and wizardry with the intricacies of corporate business operations make him an important member of Magnolia's executive department. How he got to be a business expert can be traced through his unquenchable thirst for the study of accounting. At heart, R. M. Chan is a student.

Chan was born in Wilkes-Barre, Pennsylvania, where his grandad's home was the first to be gas lighted. It was, of course, artificial gas made from coal. He had no idea as a boy that when he became a young man he would begin making a career in another form of hydrocarbons—oil.

Ever since Chan was graduated from high school he has been studying accounting. He got his first taste of balance sheets and ledgers when, fresh out of high school, he got himself a job in New York City and began a night college course. When World War I began he was still at it, but by then he had learned enough to pass the New York State Examination for Certified Public Accountants. Then he joined the army.

Following his service overseas, Chan returned to New York and took up his accounting and auditing work where he had left off. He worked for a while in an investment banking firm, Bonbright and Company; then served the same and other firms in a consulting capacity making investigations and compiling financial and corporate reorganization reports.

By 1926 R. M. Chan had gained such a wide experience from his various business ventures that when he joined the Duz Company, a soap manufacturing concern, he soon became its vice president. Then in 1929 when Procter and Gamble purchased the assets of the Duz Company, Chan moved to the newly formed Vacuum Investing Company, an affiliate of the Vacuum Oil Company, organized to acquire interests in businesses distributing petroleum products in Pennsylvania, Ohio, and the vast midwest areas.

"We were busy in those days," Chan recalled recently. "During one eighteen-month period we purchased controlling interest in about 50 separate businesses, including such companies as Lubrite Refining Corporation of St. Louis, Wadhams Oil Company of Milwaukee, and the White Star Refining Company in Detroit." Today the operations of these same companies form part of the divisional activities of the Socony-Vacuum Oil Company.

At the time of the merger of the Standard Oil Company of New York and the Vacuum Oil Company in 1931, Chan was again a vice president—this time with the Vacuum Investing Company. After the merger, he was made a member of Socony-Vacuum's central marketing department and occupied that position until his transfer to Magnolia on July 1, 1935, as comptroller.

ROBERT M. CHAN
Vice President
Magnolia Petroleum Company

His executive skill in accounting asserted itself again, and in 1942 he was made an assistant vice president and elected to Magnolia's board of directors. In 1945 he was promoted to a full vice presidency.

As a Magnolia executive, Chan's sound background of oil business operations and his eagerness for new ideas, equipped him to handle special duties in wide and diverse fields. But he's always taken such assignments in his fast stride and has come up with neat answers to knotty problems.

Though Chan is a director of the Texas Mid-Continent Oil and Gas Association, a member of the American Petroleum Institute and other industry organizations, he has not limited his skill and interest to oil. Active in civic work, he is a member of the board of directors of the Dallas Y. M. C. A. and the Neighborhood Recreation Association—both Community Chest agencies. He has been a director of the Community Chest since 1949 and last year was chairman of its important budget committee. For 1952 he is still a director and treasurer of the Chest. Chan is also a member of the Dallas Athletic Club, the Dallas Country Club, and the Dallas Petroleum Club, which he served as president two years ago.

Magnolia employees working under Chan's leadership call him friendly, courteous, business-like, and capable of carrying large responsibilities. Those responsibilities are so varied and demanding that Chan sometimes facetiously calls himself "vice president in charge of confusion." The job of being an executive in the highly competitive oil industry today calls for the utmost from a man in business skill, linked to a likeable, friendly personality. Bob Chan is that kind of a man.

The Great Basins

In ancient geological times ice formed and then melted time and again over the North American continent. Huge inland lakes were formed where marine life multiplied and land creatures flourished on the lush growth bordering the lakes. As the shores receded marine life died along the shores and the animal life followed the receding waters. Eons later the lakes dried up and were lost under new sands of time or were swallowed in convulsions of the aging world.

When settlers came to the New World and later invaded the West, the basins in the Rocky Mountain area apparently had little to offer. Some were wrapped in a forbidding terrain. There was grass for grazing but few remained to build homes and take out homestead claims. They passed over the basins to the rich silver in the mountains, or on to the gold in California. They neither knew nor cared that beneath the surface of the basins they crossed, lay deposits of petroleum that in 1952 would create beehives of activity.

The great basins are at last coming into their own in the fortunes of man. They waited for technological advance and a driving demand for the petroleum the geologists said they held in great reservoirs deep in these great thicknesses of sedimentary deposits.

Only five years ago they were virtually ignored, the problems of recovering their wealth too great for profitable enterprise. Now they hum with rigs that seek the treasure they hide so well.

There are the Williston Basin, in the Dakotas and Montana and Canada, perhaps the greatest of them all and, with all the activity, so far barely touched by the knowing drill; the Uintah Basin (which we cover in this issue) in Utah and Colorado, mostly land still owned by the government because settlers could not produce a livelihood on its surface; the Denver-Julesburg Basin, in Nebraska and Colorado; the San Juan Basin in Colorado and New Mexico, perhaps reaching Utah and Arizona—sometimes called the Four Corners Area; the Anadarko Basin in Western Oklahoma and the Texas Panhandle and perhaps a greater region; the Permian Basin in West Texas and New Mexico, where the new Spraberry is succumbing to technological skills so recently gained.

These are some of the great basins that hold the key to future oil and gas production. These are the "Areas of Promise." The geologists and geophysicists say the deposits are there. All the oil industry has to do is find them, develop efficient methods to produce and separate the oil and gas and process them, and price the products low enough to keep consumers buying and high enough to make a profit so the work can go on.

A tall order?

Certainly, but it is being done.

Back "Point Number 4" with

Designed to conserve and to stretch supplies of tubular goods, Point No. 4 of P.A.D.'s "Four Point Oil Country Tubular Goods Conservation Program" reads as follows:

"4—Wider use of dual completions *—the practice of tapping two or more petroleum reservoirs with a single well bore."*

You can s-t-r-e-t-c-h your supply of tubing and casing to the maximum by using the Baker Retainer Production Packer, Product No. 415-D, with its efficient, adaptable Accessory Equipment for "dual completions" that are permanent, economical, and permit practically any future down-hole operations.

Dual completions of the past quite often utilized steel body type packers which were not too well suited to certain installations, were subject to corrosion and attack by deleterious well fluids, and were difficult to mill out in case of emergency, or when subsequent operations necessitated their removal.

When planning a dual completion today, a good starting point is to think of the Baker Retainer Production Packer which eliminates the above objectionable features.

All major parts of this packer are made of gray cast iron which is *far more resistant to corrosion and embrittlement than steel*—and yet can be *drilled up readily* (not milled) when desired. The oil-resistant, temperature-resistant packing element is held in position by lead sealing rings, and provides a leak-proof seal which *prevents movement* of fluid or gas *either up or down the hole.* Two sets of opposing slips hold the packer assembly at setting point regardless of differential pressures, set-down weight, tubing expansion or contraction.

The Baker Retainer Production Packer is truly revolutionary because, when set, it *virtually becomes a part of the casing,* leaving the tubing string *free for running in* or for *removal from the well,* meanwhile maintaining complete isolation of the producing zones.

The Baker Retainer Production Packer can be set safely and accurately on tubing or drill pipe, but to save wear and tear on precious tubular goods, we recommend setting on an electrical conductor cable by one of the leading wire line service organizations. After reviewing the two dual completion installations on the opposite page, we suggest that you contact the nearest Baker representative for helpful, profitable recommendations. —Then, by selecting the required Baker Packer Accessory Equipment, your specific "dual zone" or single-zone production requirements will be readily met.

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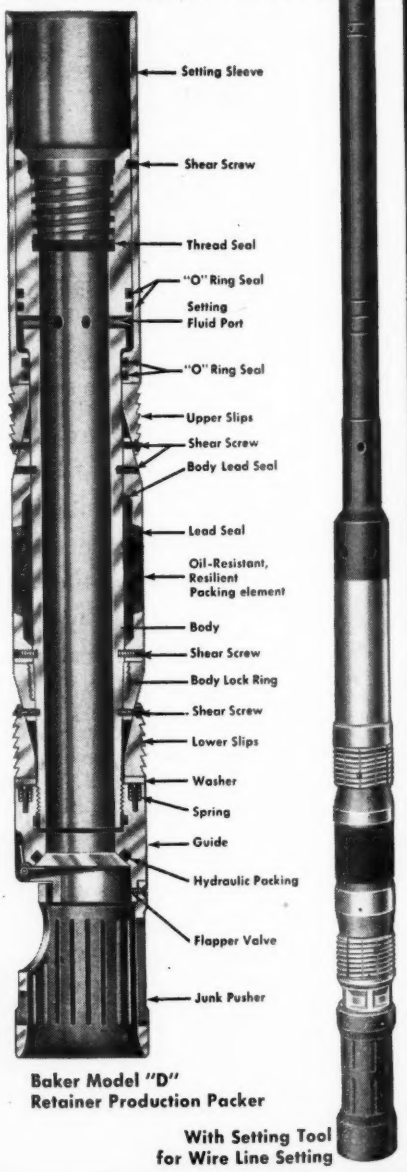

Baker Model "D" Retainer Production Packer

With Setting Tool for Wire Line Setting

WIRE LINE SERVICE AVAILABLE FROM...

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YOU SAVE TUBING AND CASING

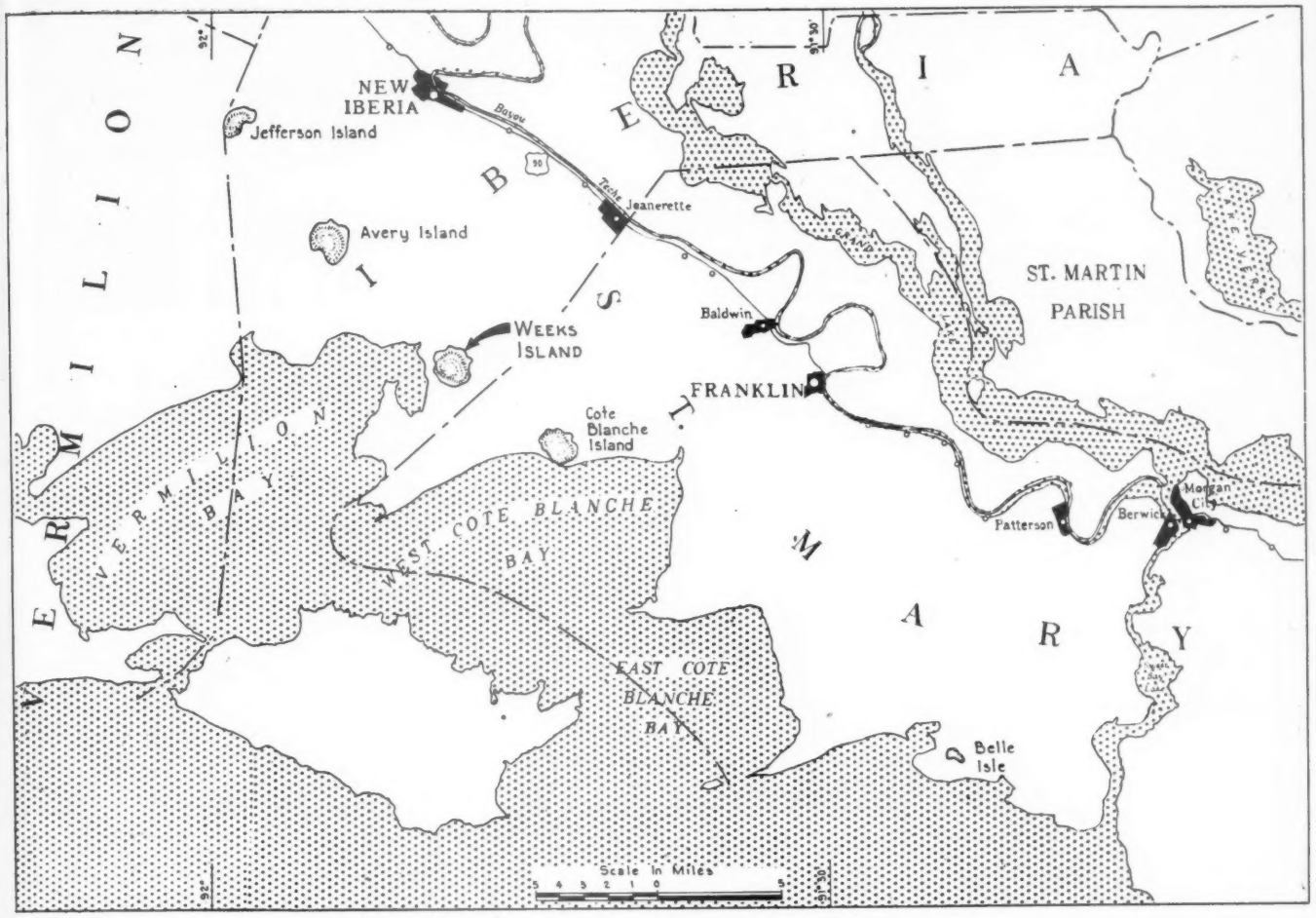


FIG. 1. Arrow shows Weeks Island, one of "Five Island" chain of piercement-type salt domes in marshland of Coastal Louisiana.

WEEKS ISLAND

Drilling techniques in the deepest oil field in the Gulf Coast have advanced so far that 12,000 ft is no longer a deep well

J. W. PITTMAN AND J. E. R. SHEELER

WEEKS ISLAND has the largest daily production and is the deepest producing oil field in the state of Louisiana. Since the discovery of oil on the flank of the Weeks Island dome in 1945, there have been 101 wells drilled with an average depth of 12,700 ft per well. Hole drilled to date totals more than 1,282,300 ft, or over 242 miles.

It is the purpose of this discussion to bring out the drilling technique developed in the field during this drilling, and which has made the exploitation of oil and gas at these depths routine under similar conditions. It should be mentioned that only conventional Gulf Coast drilling equipment, tools, and methods have been employed throughout the drilling campaign.

Weeks Island is a member of the well-known "Five Island" chain of the piercement-type salt domes occurring in Coastal Louisiana, which includes Jefferson Island, Avery Island, Weeks Island, Cote Blanche Island and Belle Isle. See Fig. 1. The geological features of these uplifts, which rise as high as 135 ft above sea level, have been known for many years. The first exploitation of these islands began in 1862 with the discovery of rock salt on Avery Island. An almost chemically pure salt is now also mined on Weeks and Jefferson Islands. Commercial oil or gas accumulations have been found on the flanks of all five structures.

The Weeks Island is some two miles

EXCLUSIVE

in diameter and is nearly circular; see Fig. 2. Commercial oil and gas accumulations are found on all flanks of the dome at depths ranging from 2094 to 16,612 ft. To date, the development of this field has been carried on by the Shell, Humble, and Gulf companies, with Shell being the largest operator in the field. At the present writing, Shell has completed 67 wells and maintains a five-string drilling program. Humble has completed 31 wells and operates one drilling string, including some joint operations with Shell. The Gulf-Shell operations have completed three wells and maintain a one-string drilling program.

The outstanding feature of the Weeks Island field is the unusual depth of the formations from which oil or gas is obtained. This deep production, to date, is found on the north, east, and south flanks of the dome. In this area, Shell has drilled 54 wells having an average depth of 14,092 ft per well. The technique employed in drilling these wells varies little from that used in the development of any other Gulf Coast salt dome. In the early stages of development, considerable mechanical difficulties were encountered, and hardly a well was drilled without one or more fishing jobs. The average well completion time was well over 200 days per well. As more wells were drilled, and the data gained from them studied, the mechanical difficulties and the well completion time were considerably reduced. Wells are presently being drilled and completed at an average depth of 13,800 ft in an average of 65 days. The fastest well drilled and completed to date was Smith State Unit "B" No. 12, which was drilled to 13,900 ft and turned into the tanks in 59 days.

The principal factors that contributed to a reduction in drilling time may be summarized as follows:

(1) Careful consideration of the drilling time in the various formations with varying types of bits and carrying the information from well to well through formation correlation;

(2) Maintenance of a straight hole, less than 2 deg deviation from top to bottom, even at the expense of slowing down drilling time (thereby eliminating the risk of key seating which was believed to have led to numerous and lengthy fishing jobs during the early drilling).

(3) Use of oil emulsion mud at depths below 12,000 ft (this type mud has increased penetration rates somewhat and considerably reduced tight hole conditions which were believed to have led to stuck drill pipe on bottom).

(4) Modifications in casing design, which will be discussed in following paragraphs. This, in recent years, has of course been substantially affected by the availability and the necessity of conserving tonnage in tubular goods.

The above factors combine to reduce the number of days during which operations are conducted in an open hole. This combined effect was a major objective since the deterioration of uncased holes (sloughing, key seating, hole enlargement, etc.) in Weeks Island, as in other Gulf Coast fields, is a factor of time.

For the purpose of a more detailed discussion of the conditions affecting the drilling to these depths, all wells on the north and east flanks of the field can be conveniently divided into three structural categories, see Fig. 3.

The "shallow" or Type A wells aver-

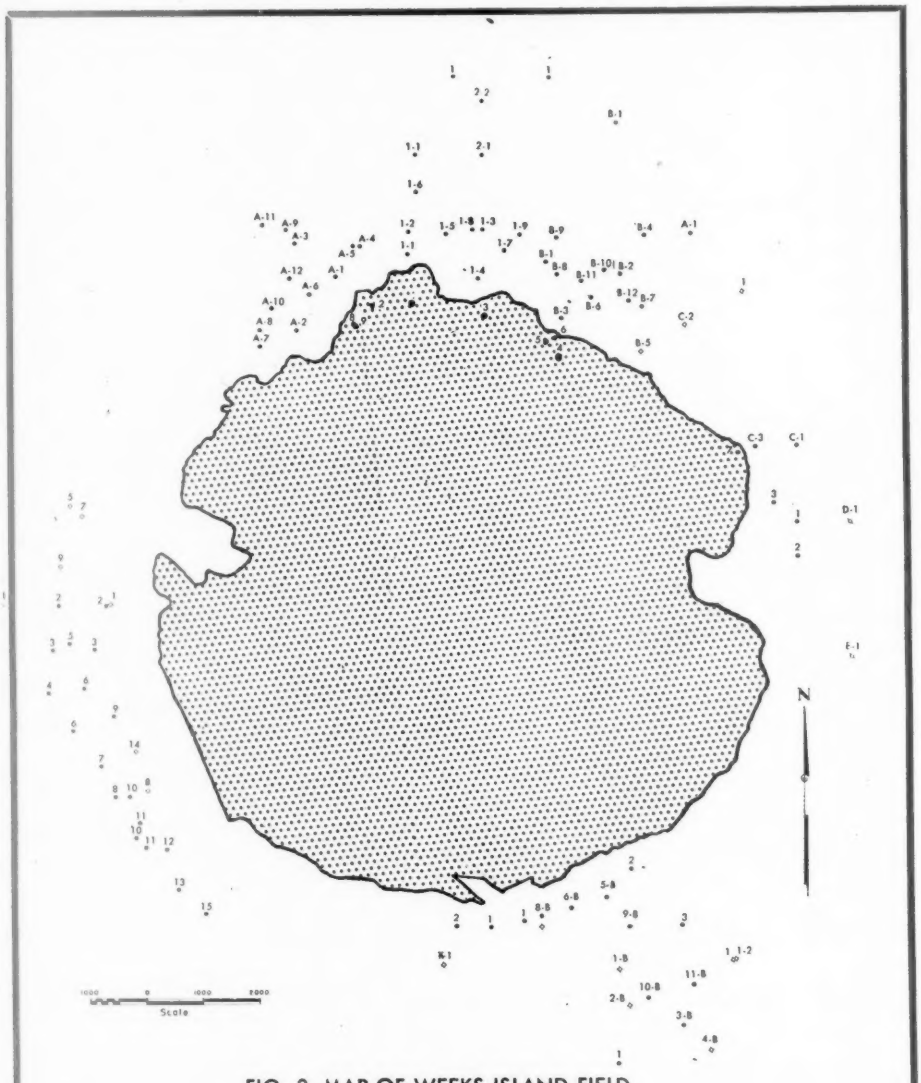
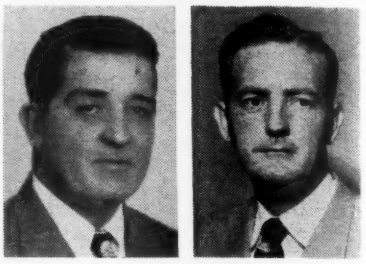


FIG. 2. MAP OF WEEKS ISLAND FIELD
Showing outline of topographical relief of Island and well locations.

The Authors



J. W. Pittman J. E. R. Sheeler

J. W. Pittman and J. E. R. Sheeler, both members of Shell Oil Company's New Orleans area staff, have had considerable experience in the development of Louisiana oil fields.

Pittman joined Shell at Kilgore, Texas, after graduating from Texas A. & M. with a degree in electrical engineering. Pittman's first acquaintance with Louisiana was in 1936 at Shell's Iowa field in Louisiana. After a brief stint in Houston, Texas, as an exploitation engineer, he returned to Iowa as division production engineer for Shell, then back to Kilgore where he became district production superintendent. Pittman became Shell's district superintendent at Lake Charles in 1945, then division manager in 1946. In 1948 he took over his present job, New Orleans area production superintendent.

Sheeler, New Orleans area exploitation engineer—mud, for Shell, was graduated from Louisiana State University with a degree in petroleum engineering. His initial assignment with Shell was in White Castle, Louisiana. Later he served as exploitation engineer in the Iowa, West Lake Verret, Black Bayou, Happytown, and Chalkey oil fields. He moved to New Orleans as senior exploitation engineer in 1948 with promotion to his present job in 1949.

aging 12,400 ft (see Fig. 3) are situated high on the structure in close proximity to the salt plug and have proved to be the most difficult and costly wells to drill. Type B or "Fairway" wells (drilled to an average total depth of 13,800 ft) are a sufficient distance from the salt plug so that salt drilling, mineralized, and steep dipping formations are not encountered. Type C wells are situated at considerable distance from the salt plug, and production is found below 15,000 ft, see Fig. 3.

The Type A wells, which are adjacent to and generally penetrate a salt overhang, have presented many drilling difficulties. As much as 7000 ft of salt overhang has been drilled, and in some wells the bit has encountered and left the salt as many as three times before reaching the objective sands. While the drilling of salt has become somewhat commonplace on the Louisiana Gulf Coast, it nevertheless complicates the mud problem and the directional control of the hole, and adds considerably to the well cost. The salt section of the hole is successfully drilled with the use of salt saturated, high pH oil-emulsion mud.

In these Type A wells all formations encountered, either immediately above or below the salt overhang or adjacent to the salt stock, are as usual highly mineralized, requiring rock bits and penetration rates often as low as 12 or 15 ft per day. The resultant slow progress prolonged drilling in the open hole to the extent that hole deterioration led to other difficulties and increased costs.

Of the first six Type A wells drilled, there were numerous fishing jobs for stuck drill pipe, and a total of eight sidetrack holes were drilled before the objective sand was reached. A careful study to determine the cause of these difficulties revealed that part of it was due to key seating below the surface pipe, which was set at 4000 ft, and that a great majority of the other fishing jobs and sidetracks were below 11,000 ft, which could be attributed to hole deterioration. A revised casing program setting 5000 ft of 13⅜-in. surface pipe and a protective string of 9⅝-in. casing at 11,000 ft was adopted. Subsequently,

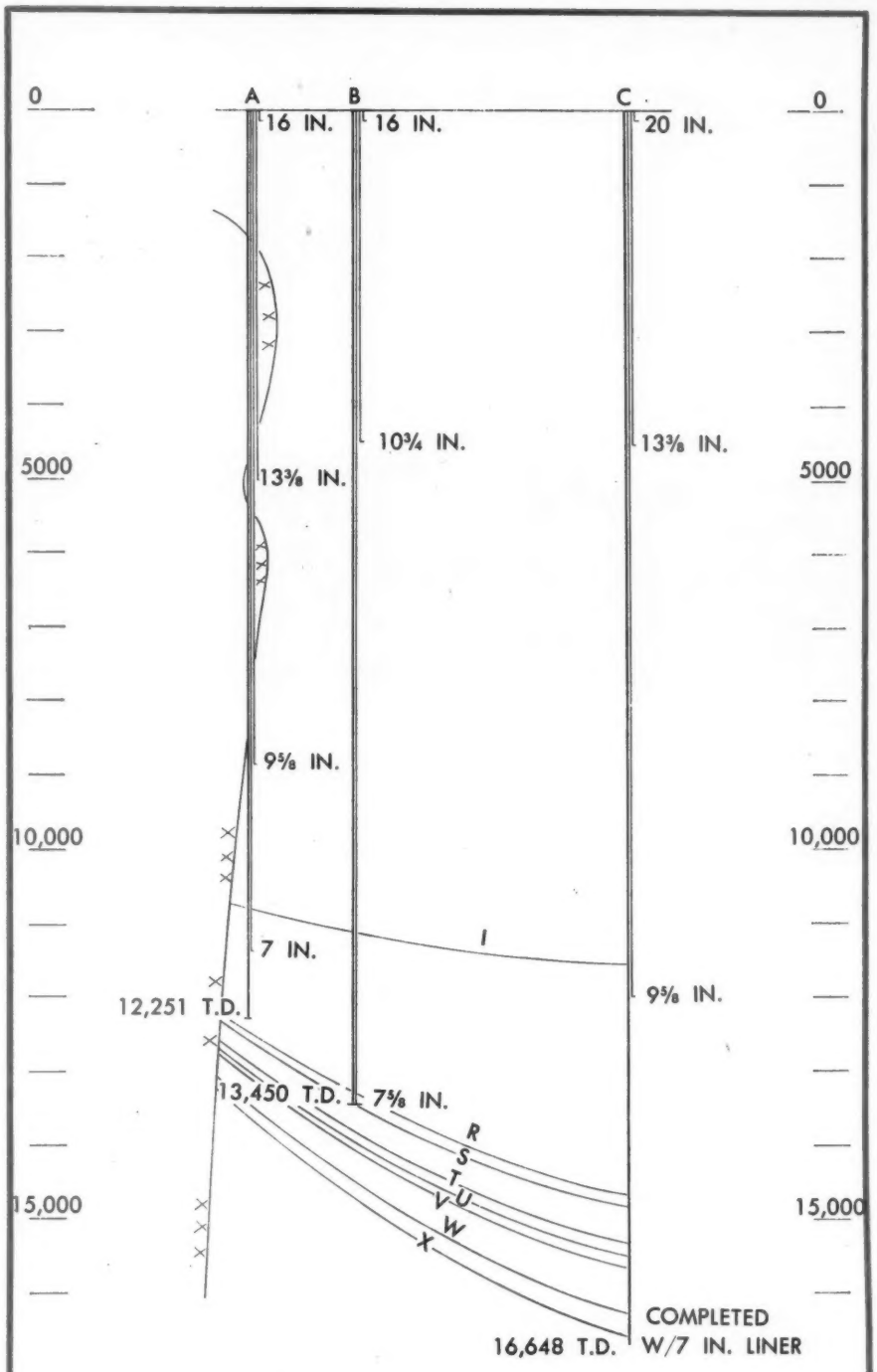


FIG. 3. Schematic N-S section of north flank of Weeks Island Dome.

WEEKS ISLAND PRODUCTION

The Department of Conservation, State of Louisiana, made the following allocation of oil production for Weeks Island field effective February 1, 1952:

Company	Bbl a day
Gulf Refining Company	1,125
Humble Oil & Refining Company	3,437
Shell Oil Company	22,458

Total production for the field allowed by the proration order is 27,020 bbl a day.

four Type A wells have been drilled to their objective zone at about 12,400 ft without encountering any adversities. These wells are now drilled and completed in an average of 148 days at an average cost of approximately $350,000 per well.

The Type B wells, which have an average completion depth of 13,500 ft, are completed in an average of 67 days. These wells are at a structural position a sufficient distance from the salt mass so that the high mineralized and hard drilling zones are not encountered. The general casing program for these wells is 16-in. conductor at about 120 ft, 10¾-in. surface pipe at 4500 ft, and usually 7-in. oil string at total depth. A high pH starch lime mud weighing 10 to 10½ lb per gallon with a water loss of about 8 cc's is used down to 12,000 ft. At this depth, approximately 12 per cent by volume of diesel oil is added to the mud flush. The current average cost of these wells is approximately $200,000 per well.

The Type C wells encounter similar conditions to the Type B wells. Other drilling complications arise, however, as a result of additional 3000 to 4000-ft

Weeks Island was pushed up from southern Louisiana marsh by a salt plug. Completed wells and drilling rigs are on the outer rim of the island.

of hole required to reach the objective sand. The formations become progressively more compact and consolidated with depth, and the rate of penetration slows down in proportion. Because of the additional drilling time and depth, a protective string of 9⅝-in. casing is set at 12,000 ft, and completion thereafter effected by use of a blank liner at total depth. These wells are drilled and completed in an average of 220 days at a cost of approximately $500,000 per well. The average drilling time has been substantially reduced with each well, and in fact at this writing, a current drilling well had reached 15,325 ft in 82 days and was expected to be completed to the tanks at a depth below 15,300 ft in less than 100 days from the date of spudding.

In the drilling of the Type C wells critical temperatures (285 to 300 F) for mud flush and cement slurries are encountered. In the recent drilling of Gonsoulin Minvielle No. 1, which reached a depth of 16,648 ft, temperatures sufficiently high to cause solidification of the mud were encountered at approximately 16,000 ft. The mud flush at the time was a high pH lime-oil emulsion mud weighing 12.5 lb per gallon. The gelation was overcome by treating the entire mud system with 5 lb per barrel of chemical thinner and thereafter maintaining an excess amount over the normal daily treatments of thinner. This method has proved successful as evidenced by the fact that the drill pipe was out of the hole for more than 24 hours at a depth of 16,648 ft, and electric log and liner were run without further difficulty.

The above temperature range resulted in serious complications in the cementing of pipe at these depths. In fact, no cement had been manufactured to meet these conditions, i.e., at least a two-hour pumpability under this temperature range. Through laboratory study in cooperation with research engineers it was learned that a special cement retarder could be added to a standard brand of slow set cement to obtain the desired pumpability without detriment to the cement properties. These studies further showed that, due to the variation in individual lots of cements, it would be necessary for each lot of each brand of cement to be pre-tested before use under these conditions. This specially retarded cement and pre-testing is currently being successfully used for a cementation of deep liners in the Weeks Island field.

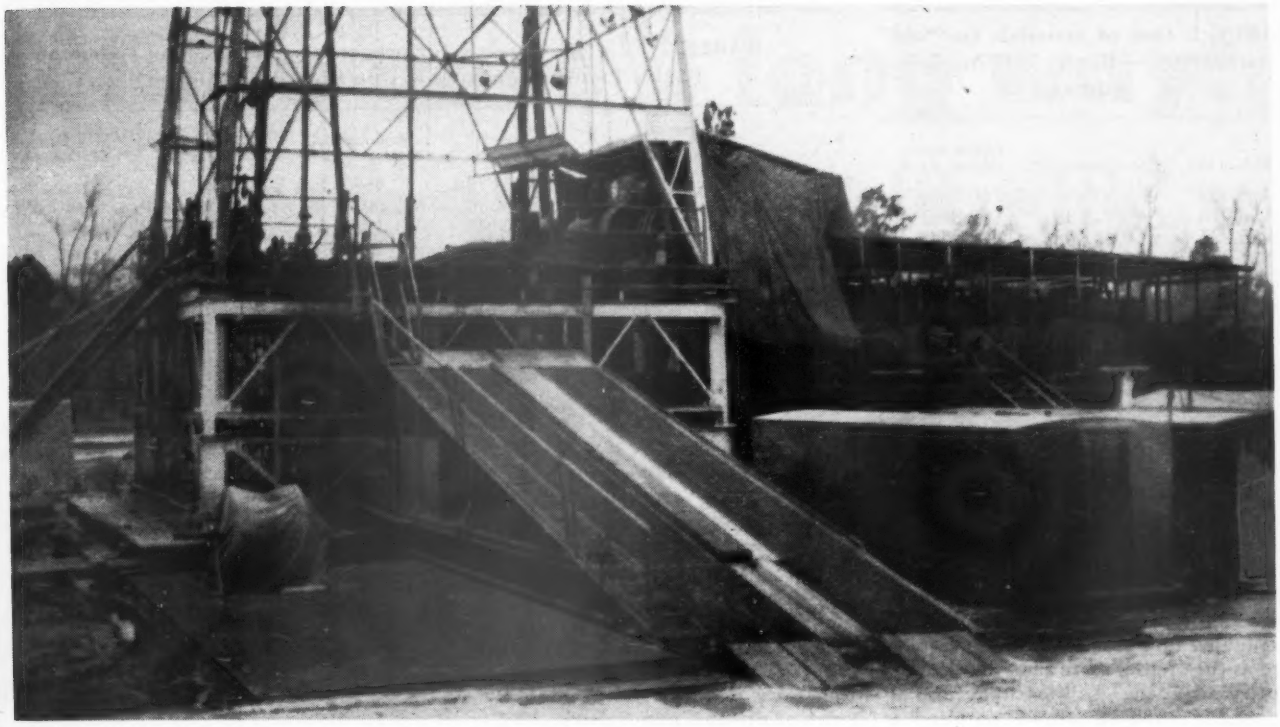
* * *

Russia Claims Wells Can Be Drilled Without Mud

The Soviets have announced that they have developed a new method of drilling for oil without drilling mud. They claim that this method speeds up the drilling of wells and offers a great savings in state funds. As oil is one of Russia's principal commodities, technicians and engineers are working constantly to find new ways to get at the oil quickly. Sharif Fatkuliev, a technician of authority, stated that the "Baku oil wells have long been famous for high-speed drilling. The Konsomol Brigade headed by the young foreman Aga Dadash Kerbalai Ogly in August last year attained the unparalleled speed of 5212 meters a month of drilling time," Fatkuliev added.

U. S. oil technicians explained that the 15,650 ft a month drilled by the Russians is considerably under the 60,000 ft a month some times drilled by U. S. drilling crews. They added, however, that they were "completely baffled" by the Russian claim of dispensing with drilling mud.

The Russian technician further reported that he received orders to "drill a well to a depth of 1560 meters on the territory of a newly opened deposit. According to the geological technical system of drilling it was recommended to drill a 2-column well with the use of a weighted clay mixture." He added that he tried it without the mud at a higher rate of speed, reducing completion time 40 days, as well as saving the state about $75,000. High speed drilling of wells without a weighted clay mixture has been adopted in the Baku fields, Central Asia, Grozny, Krasnodar and other oil fields.



Ragley D-1 rig showing space at left where temporary mud system was set up.

MUD TROUBLE

The deepest well in Louisiana tried—but failed—to stump the operators with high bottom hole temperatures and sloughing shale.

ERNESTINE ADAMS*

WHEN you have an interesting hole 3 1/3 miles deep and the mud won't let the electrical logging tools down—what do you do? Magnolia engineers came up with a drastic solution and—with a combination of scientific mud engineering and some ingenious mechanical operations—made it work.

Magnolia Petroleum Company's Ragley Lumber Company D-1 was rigged up with Company Rig No. 50, a power rig, and was ready to go on June 20, 1951, and at 5 o'clock that afternoon it was spudded in. The well is about 3 miles east of the Hurricane Creek field in center of SE quarter of NW quarter of Section 29-5S-7W, Allen Parish, Louisiana. Magnolia had a permit to drill to 15,500 ft in search of oil and gas. This is an unusual depth even in this general area of relatively deep wells.

The scheduled casing program was customary practice in the area for deep drilling: 200 ft of 20-in., 2500 ft of 13⅜-in., 10,000 ft of 9⅝-in., 15,500 ft of 7-in., and a flow string of 15,500 ft of 2½-in. tubing.

In this hole casing was set:

June 21—250 ft of 20-in. with 250 sacks of cement.

July 2—4010 ft of 10¾-in. with 120 sacks, 2 per cent gel.

November 30—13,824 ft of 7-in. with 960 sacks cement with 120 sacks of expanded perlite and followed with 100 sacks of neat cement (total 1180 sacks).

From 13,824 ft on, the well is open hole, 5⅞-in. in diameter. The drilling string is 3½-in. 13.3 lb drill pipe. The long stretch of open hole is possible because the formation is fairly well consolidated, and special care was taken to keep the hole straight.

EXCLUSIVE

A low pH caustic-quebracho mud was used at the beginning of operations, then it was converted to lime base mud on July 17 and again converted on August 4 to lime base oil emulsion.

Wells in that area have abnormal pressure but there were no "kicks" at the Ragley D-1; however, on some occasions after being out of hole for some time, gas-cut mud was circulated off bottom. Rock bits were changed regularly before worn out to minimize the chances of losing a cone in the hole and to keep the hole straight.

The operation was rotating along smoothly and there was increased interest in its deep tests. The drilling permit, obtained from the State of Louisiana, was increased to 18,000 ft and later to 20,000 ft.

A successful electric log was run at 17,486 ft on December 19, 1951.

Two days later the trouble began.

*Managing Editor.

TABLE 1. Cost of materials for "old" mud system—Ragley "D" No. 1—wildcat.

Depth in feet	Cost of materials*	Cost of materials/foot of hole
8,459	$ 326.31	$0.0386
10,016	8,073.48	0.8061
10,997	9,391.58	0.8540
11,971	15,869.41	1.3257
12,983	19,456.76	1.4986
13,985	30,594.58	2.1877
15,012	37,024.36	2.4663
16,030	41,823.79	2.6091
16,987	45,347.71	2.6696
17,498	47,700.87	2.7261
17,836	59,790.67	3.3522

* Prices at Lake Charles; does not include drayage to location.

TABLE 2. Cost of materials for preparation of new mud system on Ragley Lumber Company D-1 on basis of 750 bbl system.

Material	Amt. material req'd. per bbl	Amt. material req'd. for system	Cost of material per unit	Total cost materials
Water	0.624 bbl	468.0 bbl		
Bentonite	8.000 lb	6,000.0 lb	$ 0.02 per lb	120.66
Caustic	1.500 lb	1,125.0 lb	0.06 per lb	67.50
Salt	1.000 lb	750.0 lb	0.01 per lb	10.13
Lime	5.000 lb	3,750.0 lb	0.02 per lb	56.25
Quebracho	1.250 lb	937.5 lb	0.18 per lb	168.75
Lignitic thinner	1.250 lb	937.5 lb	0.10 per lb	93.75
Starch	10.000 lb	7,500.0 lb	0.15 per lb	1,125.00
Barites	480.000 lb	360,000.0 lb	0.02 per lb	6,116.40
Diesel Oil	0.100 bbl	75.0 bbl	5.46 per bbl	409.50
Total	1.000 bbl	750.0 bbl	$10.89 per bbl	$8,167.94

$$\text{Cost per bbl of mud} = \frac{\text{Total Cost}}{\text{Total Vol.}} = \frac{\$8,167.94}{750 \text{ bbl}} = \$10.89 \text{ per bbl}$$

Total initial cost of new mud system	$ 8,167.94
Total cost of maintenance and increasing volume of new mud system to 2/6/52	7,610.33
Total cost of new mud system to 2/6/52 (Est. total mud volume as of 2/6/52—850 bbl)	$15,778.27

Two attempts were made to obtain an electric log and both failed. The logging equipment could not go through the "gelled" mud to the bottom of the hole.

One of the hazards of deep drilling had fouled up operations. The temperature at this depth, more than 300 F, was transforming the drilling fluid into a consistency that just about required a bit of drilling itself. The mud in the bottom of the hole was circulated out and conditioned.

Logging was tried again at 17,786 ft on December 26 and again failed.

When 17,836 ft was reached two days later another unsuccessful attempt was made to log the hole.

The engineers on the job tried what might have proved to be a satisfactory solution if it had worked. They screened lost circulation material out of the mud and lowered the mud weight to reduce viscosity and gel to a minimum.

Sloughing Shale

The result is what puts drilling experts in a squeeze. The lighter weight mud failed to offer sufficient hydrostatic pressure and sloughing shale, another risk of drilling, especially in deep wells, forced the operators to bring the mud weight back up to 17.4 lb per gallon in order to go on drilling.

Surface indications and tests on January 5 gave enough favorable evidence to try another electric logging operation. The tools stopped at 16,192 ft.

What to do next?

It wasn't a new problem. It is common in Gulf Coast operations. A well sometimes is abandoned for similar reasons.

But here the situation had some new angles. They were past 3 1/3 miles down, and they could drill deeper despite the fact that it was hard to maintain circulation. But they could not get the important well information they were after. It was an expensive drilling operation as most deep drilling is. The time element increased the cost. The repeated attempts at logging and stopping drilling to wash out and condition the mud took time that cost $1200 a day for the rig alone. There was already a valuable mud in the system which, up to that time, had cost $60,000 (Table 1).

What price should you pay for a chance of new oil and gas or what price for new geological information only?

The price for saving the Ragley D-1 was largely initiative and vision and professional skill.

The engineers—those overseeing the well—agreed the mud in the entire system would have to be replaced with new mud.

Studies made at Magnolia's Field Research Laboratories at Dallas had found several factors that were, in part, responsible for the gelation of the mud. They were:

1. Higher temperature in the hole (320 F min) caused more rapid and more severe reactions that converted certain constituents in the mud to cement-like compounds.
2. Higher alkalinity of the mud system caused more nearly complete and more rapid reaction of constituents to form cement-like ingredients.
3. High clay concentrations contributed to greater gel strengths in the mud.

It was felt that any new mud would have to have a lower level of alkalinity, contain a minimum of clay solids, and yet possess other desirable mud properties that would make it feasible for undertaking further drilling.

The decision was reached to put new mud in the hole in order to be able to run an electric log and drill ahead for several hundred feet more to obtain additional well information, provided such a mud of suitable composition could be prescribed.

This problem was assigned to the Field Research Laboratories. With a background of several years of funda-

Suction pump, mixing hopper, and part of mud pump assemblies.

A little goes a long way!

Drill with

DRISCOSE*

One pound . . . or even as little as *half a pound* of Driscose to a barrel of mud . . . gives excellent results! That means that only five to ten bags are required for a 500-barrel mud system!

Because there are no fermentation problems with Driscose, no inhibitors are necessary. Less weighting materials needed, means reduced storage and inventory requirements. You use less cement for casing strings because Driscose minimizes channeling. And very little "make-up" Driscose is needed to maintain low fluid loss over a period of weeks.

Order Driscose through your regular mud dealer. Packed in easy-to-handle-and-store, 50-pound, 6-ply, water-resistant bags. No special handling necessary. Add Driscose through regular hopper. Soluble in hot or cold water.

●

*DRISCOSE *is a trademark for Sodium Carboxymethylcellulose*

DRILLING SPECIALTIES COMPANY

BARTLESVILLE, OKLAHOMA

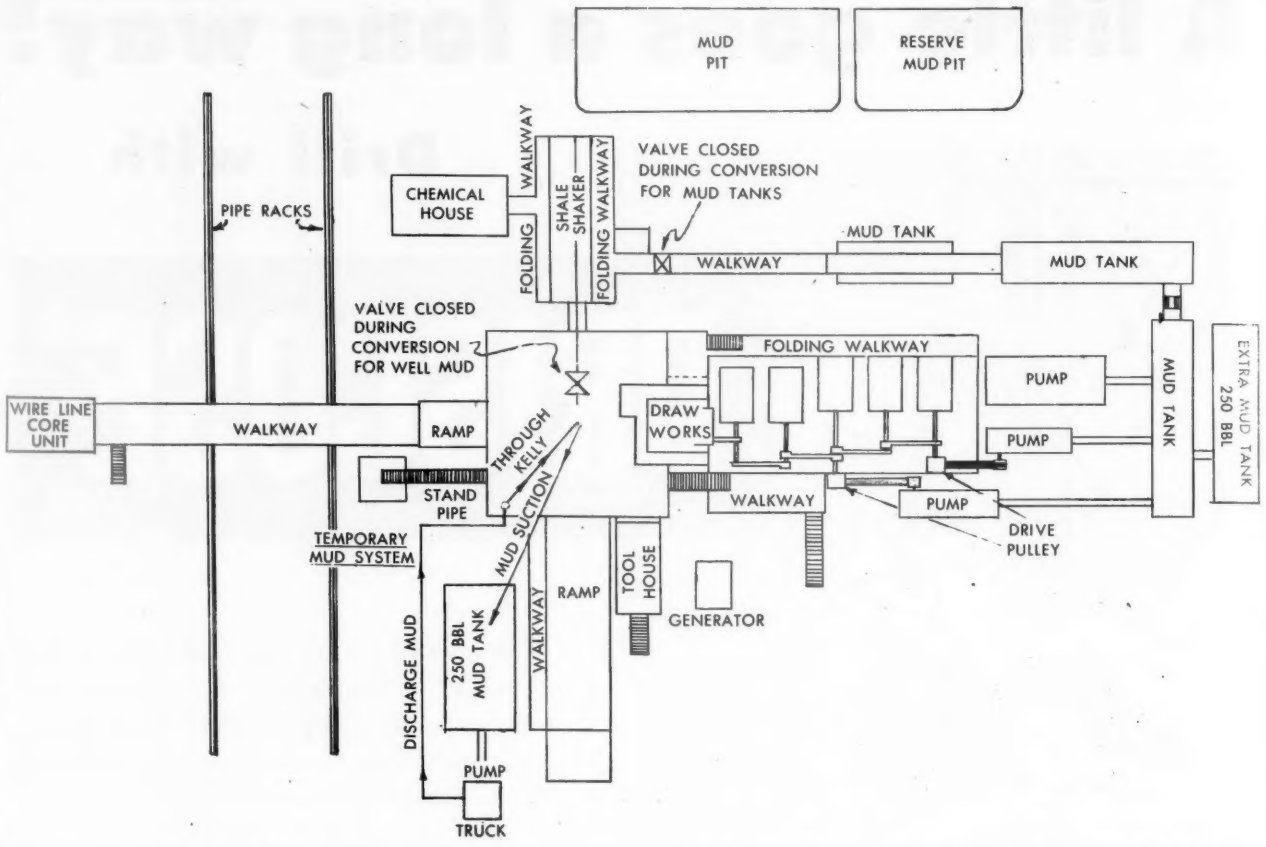


Diagram of rig showing temporary mud system set up at left bottom. Service pump truck powered system. Valves on mud system that were closed during conversion are indicated. New mud was mixed in extra tank shown at extreme right and, when ready, service pumps were tied to regular pump system while heavy pressures were needed.

mental research in drilling muds, Magnolia's scientists at the laboratories, were able to prescribe a mud composition that answered the needs of the operating engineers.

Its materials are listed in Table 2 along with amounts and costs.

The Change-Over

The next problem was how to change all the mud with the least possible interference with drilling operations. The old mud had to be cleaned out of the entire mud system and hole, because even a small amount would change the balanced formula of the new mud.

Then came the problem of determining what volume of mud would be required and how to get it prepared.

The rig had a 1000-bbl mud system and a minimum of 625 bbl of new mud would be needed for proper circulation. The hole alone held 510 bbl.

An ingenious scheme was figured out that hadn't been tried before and it worked smoothly.

A temporary mud system was set up close to the rig opposite the regular mud system. A 250-bbl mud tank was moved in and filled with the old mud. A service company pump truck was stationed behind it and the mud pumped from the truck pumps through a hose that was laid over the ramp and connected to the stand pipe and kelly. A temporary line was laid to act as a flow line to carry mud from the hole back to the temporary tank. (See diagram) This arrangement permitted the old mud to be circulated independent of the regular mud system.

In the meantime the flow line valve was closed on the regular system to block off the mud discharge from that side and the valve to the tanks on the walkway was closed so that the tanks could be cleaned out.

The job was done quickly.

On January 8 the mud tanks of the regular system were emptied and cleaned. The old mud went into the reserve mud pit.

Repairs and connections were made on mud system equipment.

So that the old mud in the hole could be completely displaced in a single operation, it was necessary to have an extra 250-bbl mud tank moved in beside a tank in the system. At 7 pm on January 9, fresh water for mixing the mud was turned into the extra tank and the ingredients of the new mud formula (See Table 2) were mixed and blended for 36 hr before the new mixture was put into the regular mud system.

Meanwhile the temporary mud system was being circulated and improvised methods of chemical additions were used as necessary, to maintain a pumpable condition of the mud.

When the new mud was prepared for use, the service company pumps were tied in to the system containing the new mud and displacement of the old mud with the new mud was begun at 11 am on January 11. A pump pressure of 3700 psi was needed to start circulation of the old mud and a pressure of 3200 psi to continue the operation.

The old mud was piped into the reserve pit as it was displaced from the hole by the new mud being pumped down the drill pipe.

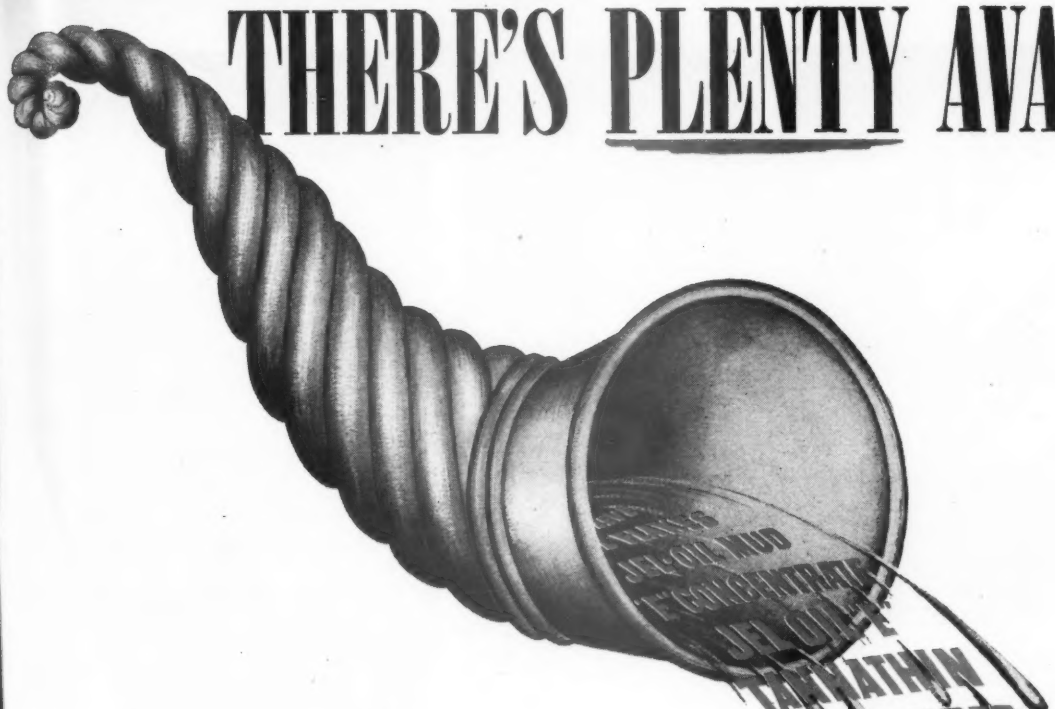
Service company pumps displaced mud from the hole for 5 hr before they were disconnected and the rig pumps were used to continue the displacement. By the time the rate of circulation was normal, a pressure of only 1500 psi was necessary.

Displacement of the old mud was continued for 3 hr more and break-through of the new mud was noted at 7 pm January 11 just 48 hr after the mixing operation began.

The break-through was shown by the change in color (new mud was lighter) and by the change in mud properties.

Mud was jetted into reserve pits for an additional 10 minutes after the break-through; the flow line was then diverted to the regular mud pits and complete

THERE'S PLENTY AVAILABLE



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In these times of shortages, we are glad to be able to tell you that **there is plenty of Magcobar drilling mud available** at fair and reasonable prices for your present and future drilling operations.

We are also proud to tell you **why** there is plenty of mud weight material . . . even though operators are now using mud weight material at the rate of 500,000 tons per year: THERE IS PLENTY OF MUD WEIGHT MATERIAL AVAILABLE AT FAIR AND REASONABLE PRICES TODAY BECAUSE MAGCOBAR PIONEERED AND DEVELOPED A PROCESS TEN YEARS AGO THAT INCREASED THE COUNTRY'S BARITE RESERVES BY MORE THAN 15,000,000 TONS.

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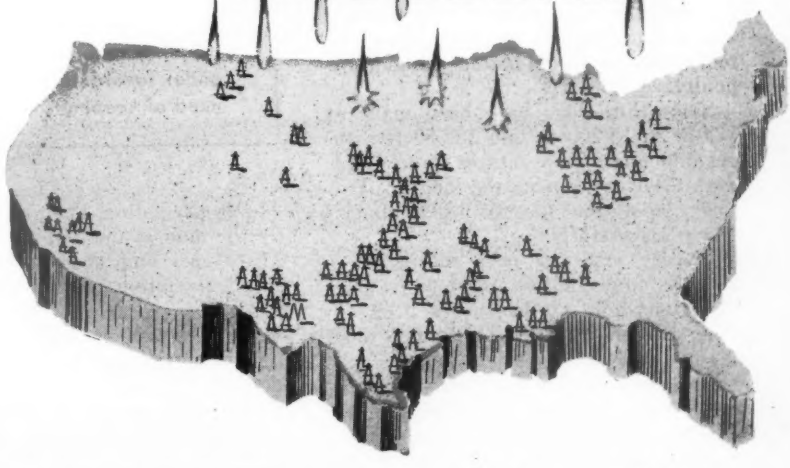

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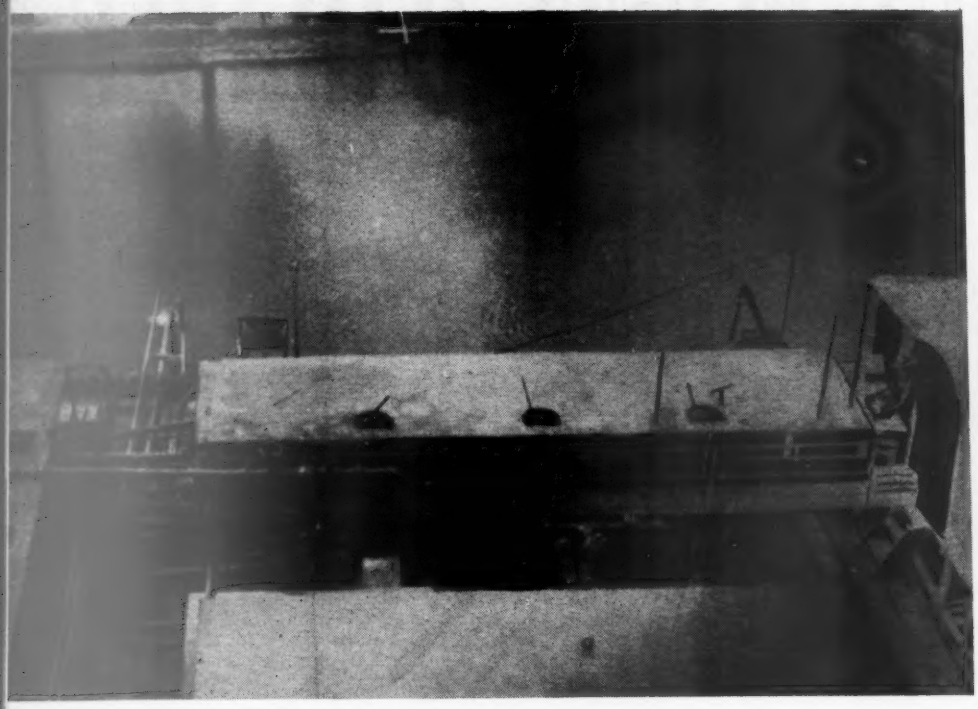
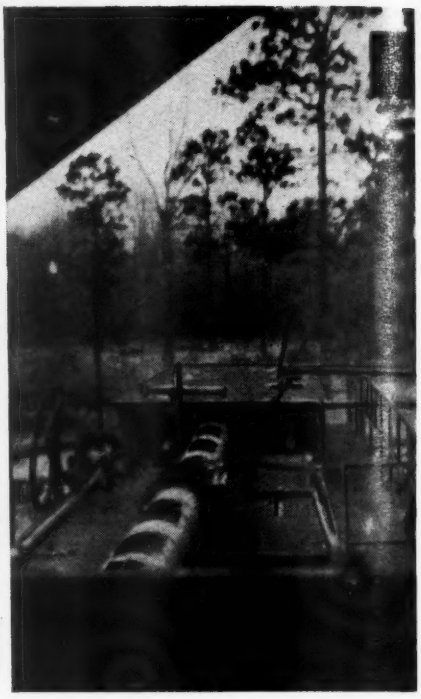


View from the fourth girth shows mud tanks, mixing hopper, and mud pumps at Ragley D-1.



Looking across shale shaker and down flow line to first mud tank.

circulation with the new mud was established.

Circulation was never lost during the entire operation of changing muds.

Mud material additions were made to increase the volume of reserve mud and these additions were completed in 30 hr.

After the displacement and build-up, the mud had the following properties:

Density	17.5 lb/gal (131 lb/cf)
API viscosity (Marsh)	85 sec.
Stormer viscosity	130 cp
Gel strength, initial	0
10 min	0
API 30 min water loss	0.8 cc
pH	12.6
Alkalinity, API	
P_f	3.0
M_f	3.2
P_{mud}	15.0

Electric Logging Tests Made

Then came the test. The 3½-in. (13.3 lb) drill pipe was removed from the hole and on January 13 the electric logging tools were run to the bottom without difficulty.

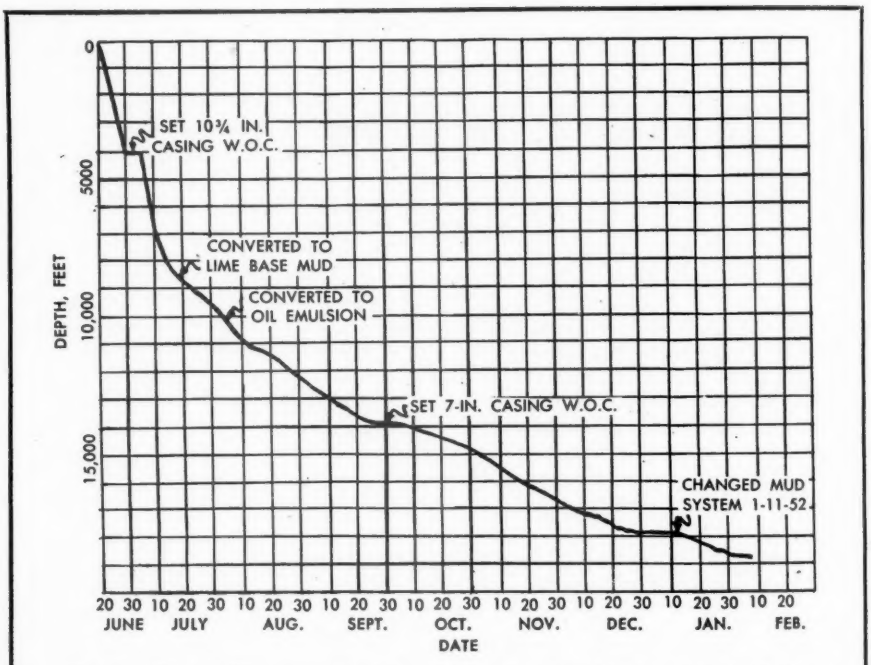
Since then, logs have been made at 18,078 ft, 18,260 ft, and 18,650 ft without difficulty; temperatures up to 322 F were measured during the logging. Two coring operations have also been undertaken successfully.

Drilling rate has been sacrificed to the more important objective of keeping a straight hole (it has never been off more than one degree) but the new mud has not slowed up operations.

Ragley D-1 is one of the deepest wells in the world and probably the deepest drilled with mud weights as high as 17.5 lb per gallon. The pressure imposed by the mud at the bottom of the hole is 17,000 psi and accordingly can withstand formation pressures that high.

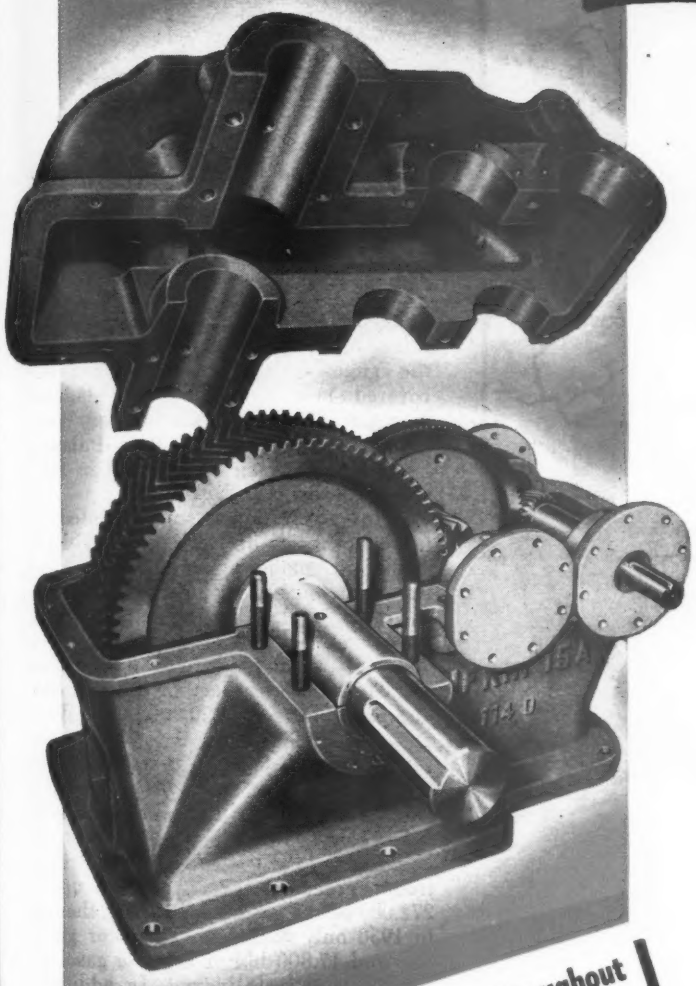
As one can imagine, the mud is watched closely by Magnolia engineers in the district and by division and laboratory personnel. The 850 bbl of new mud in the system on February 6 had cost $16,000 and its real value would be hard to estimate. The mud had served its purposes, and Magnolia will get the needed well information.

Encouraging shows of gas have been obtained and a production test of the well is scheduled. If the company doesn't find oil there, it will at least have a much better chance of finding it at some other spot on its large holdings in the area. * * *


DEPTH, FEET
0
5000
10,000
15,000
SET 10¾ IN. CASING W.O.C.
CONVERTED TO LIME BASE MUD
CONVERTED TO OIL EMULSION
SET 7-IN. CASING W.O.C.
CHANGED MUD SYSTEM 1-11-52
20 30 10 20 30 10 20 30 10 20 30 10 20 30 10 20 30 10 20 30 10 20 30 10 20
JUNE JULY AUG. SEPT. OCT. NOV. DEC. JAN. FEB.
DATE

The excellent drilling record of the Ragley D-1 is evident in this depth-time graph. It requires 6 hr to pull the drill pipe and 15 hr to make a round trip under favorable conditions. Rate of drilling is second in importance to the need of keeping the hole straight.

No "SHIP-IN-A-BOTTLE" construction on a Lufkin TWO-PIECE GEAR HOUSING



Plenty of "BEEF" throughout which is typical LUFKIN DESIGN POLICY

Provides easy accessibility for assembly and inspection

- Allows main gear to be assembled on shaft with heavy 60 ton pressed fit. All rotating parts easily set in place before cover is bolted on. No "threading" of shafts and bearings as necessitated by solid gear box with no split.
- Made of High Tensile Lufkaloy-Iron heavily ribbed inside, giving smooth exterior, pleasing in appearance and easy to keep clean.
- Large Heat Treated Alloy Steel Studs capable of carrying ten times rated load without stretching.
- Large Clean Out Hole for removing sludge from bottom of box.

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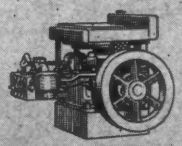

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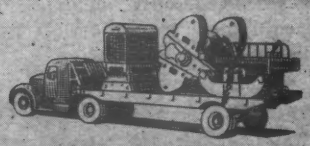
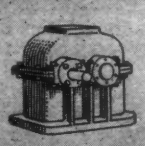


LUFKIN OIL FIELD AND INDUSTRIAL TRUCK TRAILERS



INDUSTRIAL SPEED REDUCERS AND INCREASERS

DIVISION LUFKIN FOUNDRY & MACHINE COMPANY INDUSTRIAL, MILL AND AUTOMOTIVE SUPPLIES

Old fields:
- Goilo
- Lendava

New fields reported:
- Bosnia-Hercegovina area
- Kladovo-Negotin area
- Bela Palanka

Yugoslavia*

Oil output is expected to increase with discoveries and use of U.S. equipment

CONSUMPTION of petroleum products in Yugoslavia in 1950 was about 2,100,000 bbl or about twice as high as before the war—and in 1951 probably ran substantially beyond this figure. Considerable progress has recently been made in the production of crude oil, but claims that the country would soon become independent of foreign supplies have proved to be exaggerated. It has been officially announced that production which totaled 441,000 bbl in 1949 reached 777,000 bbl in 1950. But it is now out of the question that the level of output foreseen in the Five Year Plan, which came into force in 1947 and which foresaw an output of as much as 3,150,000 tons (16,100,000 bbl) in 1951, will be approached this year.

Exploration was carried out in the inter-war period without any worthwhile results, but was intensified under German management from 1939 onwards, encouraged by the discovery of oil in neighboring Hungary. As a result, production in the Goilo and Lendava fields, in the northwestern part of the country, adjacent to the Hungarian oilfields was raised from 7000 bbl in 1939 to 350,000 bbl in 1943 but fell well below this level in subsequent years. Yugoslavia, even before her break with the Cominform, received only small quantities of oil equipment from the U. S. S. R., and petroleum developments were therefore slowed down in the first few post-war years. More recently, however, the Yugoslav Government has received first-class oil equipment from the U. S. A.; the U. K., and Germany, and has also begun the local manufacture of some items. In addition to raising output by developing old-established fields, the Yugoslavs now claim to have discovered new fields in the Kladovo-Negotin area in the northeastern part of the country, also in Bela Palanka near the Bulgarian border, and in Bosnia-Hercegovina.

Local production is supplemented by large deliveries of sterling oil, chiefly crude oil, made under the Five-Year trade agreement concluded with Britain early in 1950. This agreement provided for Yugoslav imports of up to 1,400,000 bbl of crude in 1950 (of which 1,330,000 bbl were actually delivered) and for imports of 1,050,000 bbl in 1951, and of 700,000 bbl in each of the subsequent three years. The reduction in the scale of these deliveries is to some extent a measure of the expected rise in Yugoslavia's own crude oil production. Yugoslavia is also entitled under British trade agreement to deliveries of up to 272,000 bbl of gasoline annually, though in 1950 only 85,000 bbl of motor gasoline and 17,800 bbl of aviation gasoline were actually delivered. In addition, Yugoslavia is receiving some deliveries of dollar crude oil, against credits from the U. S. A. Up to 645,000 bbl were to be delivered in 1951.

Yugolsavia appears to have had from 2,100,000 to 2,800,000 bbl of crude oil at her disposal in 1951. The country's 5 refineries, which were taken over from private oil companies, are capable of handling these supplies. The 1950 total output from the refineries included 620,500 bbl of gasoline, 565,750 bbl of kerosene, 189,000 bbl of lubricants, 611,720 bbl of gas oil, and an unknown quantity of residual fuel oil. Fuel oil output is, however, in excess of Yugoslavia's own demand, and 80,000 bbl were exported to Italy or Trieste in 1950 and 93,000 bbl in January-June 1951. There have also been small-scale deliveries of fuel oil to Western Germany.

* * *

*This is the first of a series on oil and gas development in various nations. Source for this one is Petroleum Press Service, November 1951.

JONES SUCKER RODS

We invite you to examine and compare the threads and make-up of the Jones Joint. We know you will agree that, today, these rods and couplings are the strongest and finest in any field. Why accept less than the best?

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50 Church Street, N. Y. C.

LOOK FOR THE GREEN RODS

Storm that dumped 3½ in. of rain over Ventura Avenue field knocked hundreds of wells off production. Wells in narrow canyons such as shown above were frequently buried under mud, sand, and rock. One hydraulic free pump wellhead that was buried (but continued to operate) is marked by gin pole in bottom of canyon, center of photo.

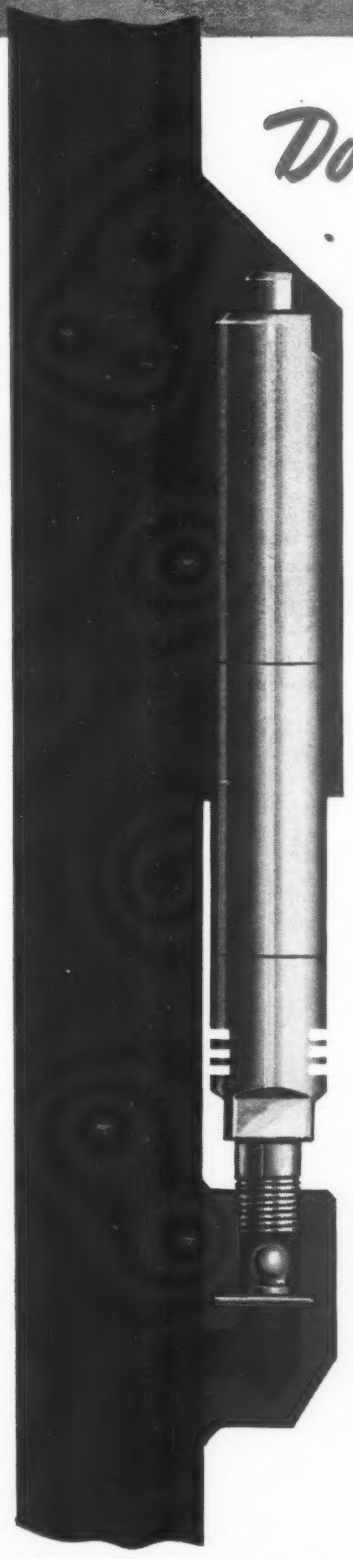
Storm Damage at Ventura Avenue Field

This hydraulic free pump well of Tide Water Associated's was completely submerged by water rushing down canyon in the storm, which hit the Ventura Avenue field, California. Well operated through the flood without interruption.

At Lloyd Corporation's hydraulic free pump wellhead, which was buried under mud and sand, top of 4-way valve and pressure gage can just be seen here. Bottom hole pump operated without interruption.

They Said it Couldn't be Done

BUT GUIBERSON DOES IT!



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produces continuous or intermittent flow with only a surface equipment adjustment

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Guiberson Surface Control Equipment...

is designed and built specifically for gas lift. Rugged, weatherproof Type "A" Motor Valve and Time Cycle Controller or Pressure Controller are easy to get to, easy to operate, easy to adjust.

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Guiberson Gas Lift Equipment is protected by the following patents:
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2,188,668 2,236,137 2,305,250 2,358,944 2,411,315
Other patents pending.

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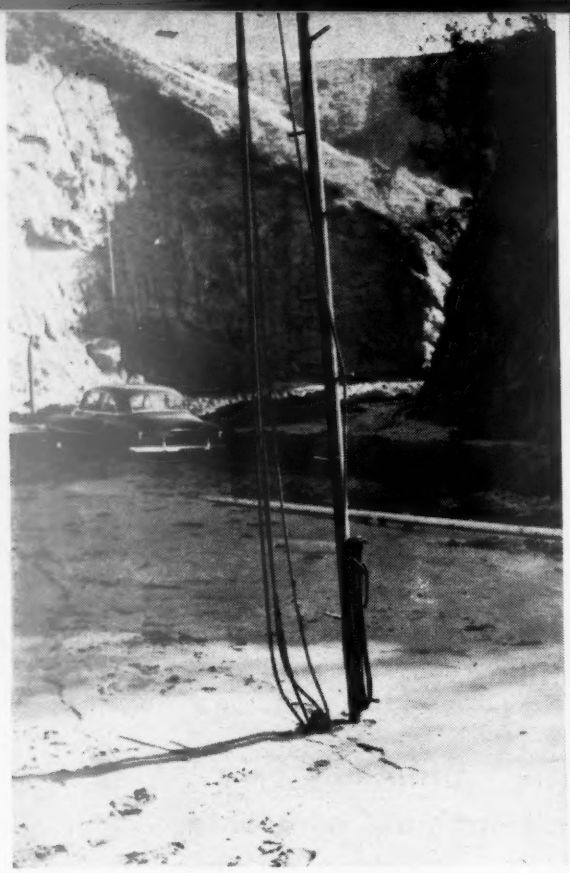
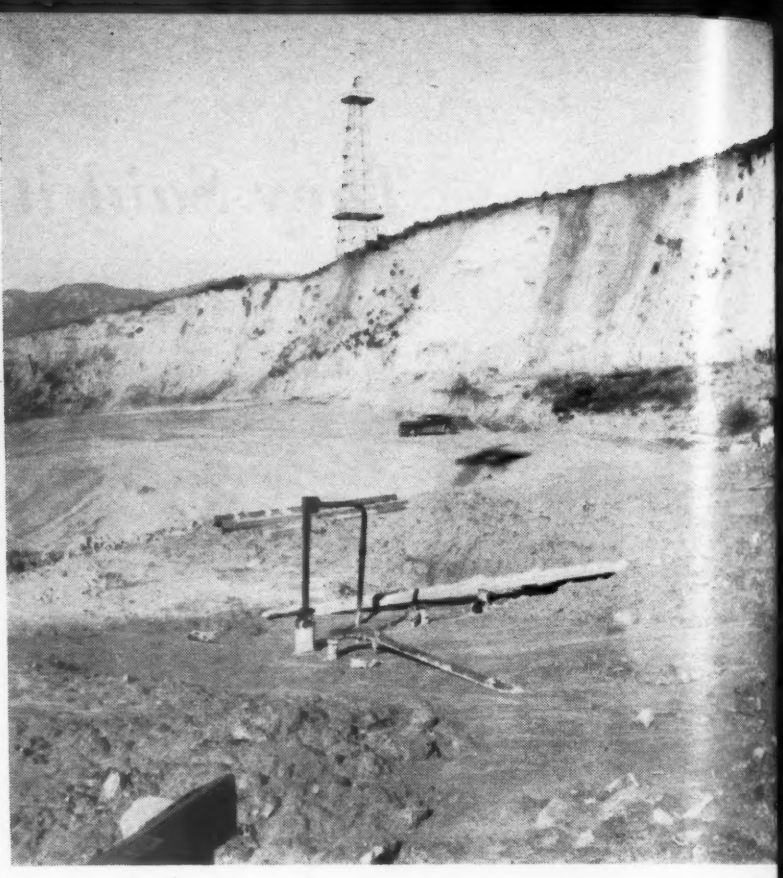
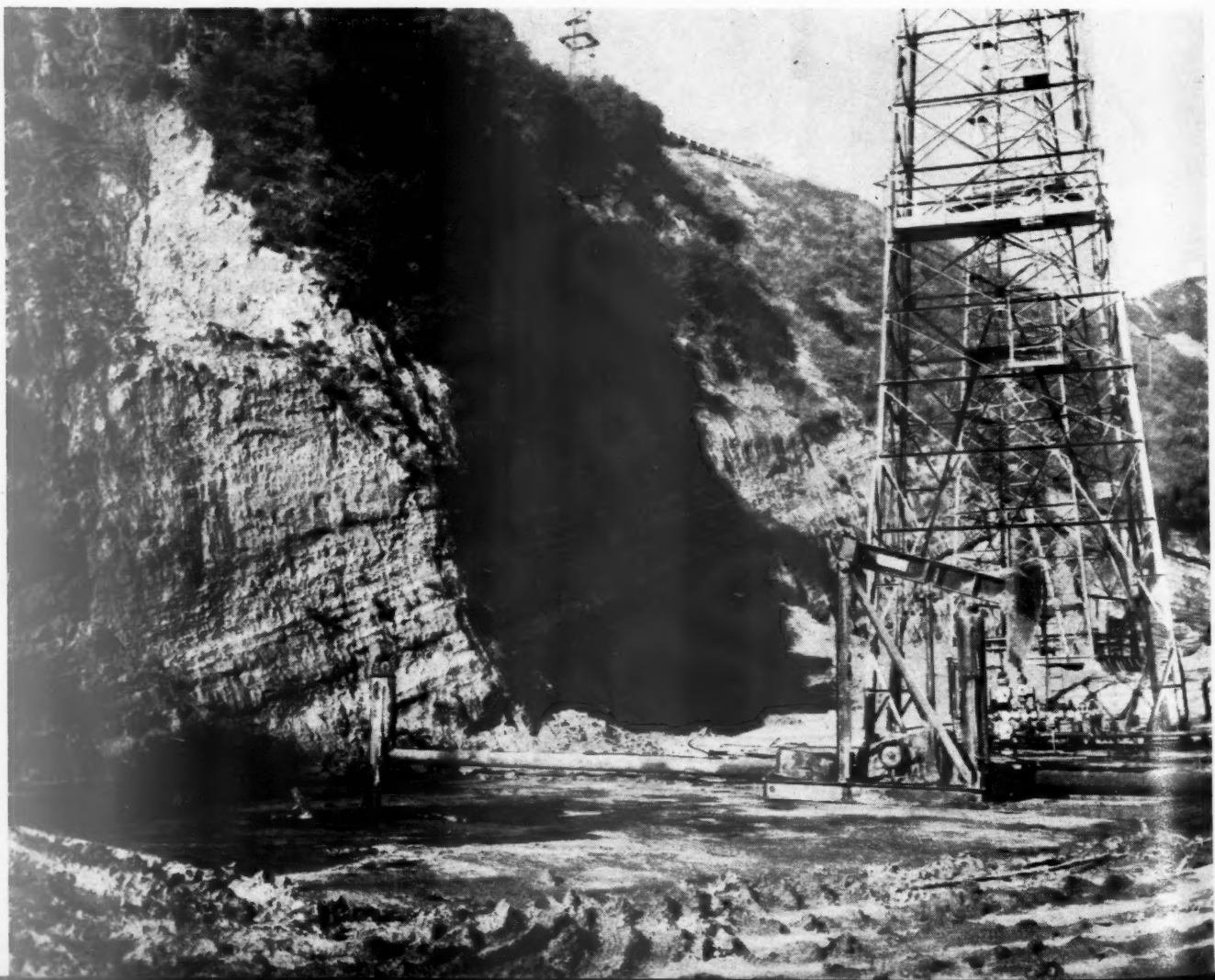


Gin pole marks a Lloyd hydraulic free pump wellhead, which was completely buried under mud and sand. Equipment continued pumping without interruption.



This conventional-type hydraulic pumping installation in the Ventura Avenue field was partially buried but survived recent storm. It is one of Tide Water Associated's, which is on the edge of major landslide in the field.

The pumping unit on this well was almost completely buried under rock slide, which fell during the recent storm in the Ventura Avenue field, California. Tide Water Associated had to employ a powered clam-shell to extricate the wellhead.



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THIS big "Caterpillar" D375 Oilfield Engine provides power for the Shulman Brothers' drilling rig near Bible Grove, Illinois. In spite of summer's heat and dust, it can be counted on to deliver steady performance day in and day out.

All sizes of "Caterpillar" Oilfield Engines, like this D375, are designed to stand up under the wide range of stresses found in the world's fields. They are so easy to operate they are practically foolproof. They run efficiently on low-cost fuels without fouling. And they deliver honestly rated power.

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Oilfield Engines

Working on pipe line construction 30 miles northwest of Rosetown, Saskatchewan.

Canada Sets New Records

Surge of discoveries may soon place Canada among the top three oil-producing nations

H. G. COCHRANE

MEASURED by any yardstick, 1951 has proved to be the biggest year yet for Western Canada's oil and gas exploration and development. Discoveries during the year have been chalked up at the rate of between one and two per week, or almost a third more than for 1950. Some 20 new major oil fields have raised the estimate of oil reserves from 1100 million barrels a year ago to today's 1700 million barrels; 30 or so new gas discoveries have upped natural gas reserves from the four trillion cubic feet estimated a year ago to eight or more trillions today.

More than 200 oil companies and syndicates, including some 65 United States groups, are spending around $4,000,000 weekly on land acquisition, exploration, and development. One hundred and forty-five survey parties were in the field during the past summer and fall; 150,000,000 acres are under lease or permit; 200 drilling rigs are in the field, divided about equally between exploration and development, and the number of completed and producing oil wells stands at around 3000 for Alberta alone.

Even a year ago there was ample evidence that oil and gas existed under most of the areas of the province of Alberta and in some sections of the Northwest Territories to the north of it. But only during 1951 have the limits of potential oil and gas producing areas in Canada's four western provinces been extended into Northern British Columbia, and to the east across the Moose Jaw-Williston Basin into southern Saskatchewan, and even to include a corner of Western Manitoba.

Here is a block of potential oil and gas country covering more than half a million square miles of sedimentary basin. It is a territory large enough to contain the four great oil producing states of California, Oklahoma, Louisiana, and Texas, and still leave considerable acreage uncovered. Yet to date less than one per cent of this vast region is under exploration, while the *rate* of exploration is only about one per cent of the intensity seen to date in the four states mentioned. It is not surprising therefore that oil men everywhere have their eyes focussed on what is going on in Western Canada.

EXCLUSIVE

Discovery Rate Increasing

The number of discoveries per year is steadily increasing. There were 17 oil and gas finds in 1947; 58 in 1949; 69 in 1950. For 1951 they have been exceeding one a week, and will total 108 all told; 40 of them oil, and 68 gas. The drill has yet fully to evaluate the oil and gas reserves discovered the past three years, but several of them will rate as major pools. Outstanding among them are Golden Spike and Wizard Lake; with pay zones exceeding 600 ft in the Devonian reefs.

Nine or ten discoveries ranging for 200 miles south-easterly from Leduc and Redwater into south-central Alberta, have opened up a wide swath of proved oil territory paralleling the Rocky Mountains. Joseph Lake proved up the first commercial oil find of 1950 from the Viking Sands, stimulating the search in the Cretaceous; Normandville brought in the first commercial sized discovery in the Peace River district; several large gas reserves have been located during 1951 in formations overlying the Devonian.

There has also been a flurry of oil and gas discoveries in 1951 north and west of Redwater and Leduc, dotting an area several hundred miles long between these fields and the recent widely heralded first oil find in Northern British Columbia at Fort St. John. This huge area is just now beginning to yield results from an intensive three years of search, and promises to turn out to be one of the best prospects for the future.

The Williston-Moosejaw Basin

During 1951 several widely scattered discoveries in Saskatchewan, Manitoba, Montana, and North Dakota, have established that prairie oil resources are not confined to Alberta alone. It is now becoming evident that what is known as the Williston Basin, centering about Williston in the Northwest corner of the Dakotas, extends northwestward in a 400 mile band some 250 miles in width, cutting across the southwest corner of Manitoba and the northeast corner of Montana, joining up with the black oil and gas areas around Lloydminster astride the Alberta-Saskatchewan provincial boundary, and the gas fields at Kinsella and Viking in Alberta.

Enterprise had been skeptical of the C. C. F. Government's attitude in Saskatchewan, and during the late "forties" had preferred to confine exploration activities to neighboring Alberta, where policy and regulations were more favorable. The declaration by Premier Douglas of Saskatchewan two years ago, however, that companies entering his

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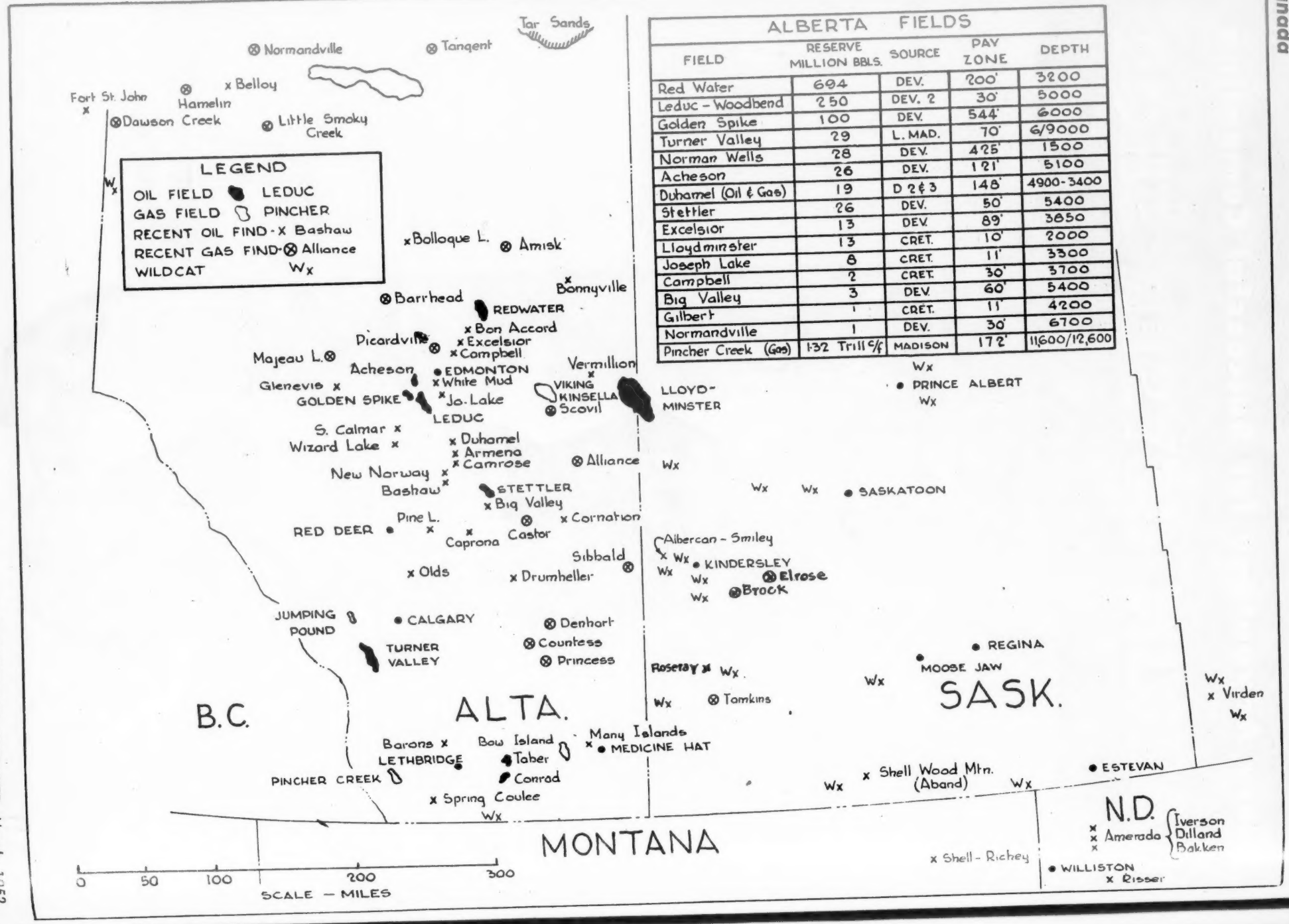

ALBERTA FIELDS

FIELD	RESERVE MILLION BBLS.	SOURCE	PAY ZONE	DEPTH
Red Water	694	DEV.	200'	3200
Leduc - Woodbend	250	DEV. 2	30'	5000
Golden Spike	100	DEV.	544'	6000
Turner Valley	29	L. MAD.	70'	6/9000
Norman Wells	28	DEV.	425'	1500
Acheson	26	DEV.	121'	5100
Duhamel (Oil & Gas)	19	D 2 & 3	148'	4900-3400
Stettler	26	DEV.	50'	5400
Excelsior	13	DEV.	89'	3850
Lloydminster	13	CRET.	10'	2000
Joseph Lake	8	CRET.	11'	3300
Campbell	2	CRET.	30'	3700
Big Valley	3	DEV.	60'	5400
Gilbert	1	CRET.	11'	4200
Normandville	1	DEV.	30'	6700
Pincher Creek (Gas)	1.32 Trill c/f	MADISON	172'	11,600/12,600

province need have no fears about possible expropriation, dispelled much of this fear. This began a rush of freehold acquisitions and confirmed the decisions of the two largest exploration permit holders to undertake major search programs.

Further encouragement was provided early last June, when the Saskatchewan government revised the old lease regulations passed and amended in 1949. These new regulations apply only to lands not now under permit or surrendered. Present permits continue under old regulations until these expire. Some of the new regulations are more favorable; for example the royalty scale is changed to a minimum royalty of half a cent per thousand feet of gas; long term low rental for acreage is provided during the exploration period; the definition of "petroleum" is changed to "any natural occurring fluid of hydrocarbons, including natural gas;" and there will be one type of permit only —a 3 year term rental at 2 cents per acre the first year, 5 cents the second year, and 10 cents the third year.

Minimum work requirements are 20 cents per acre or a minimum of $15,000 the first year; 40 to 60 cents per acre or a minimum of $15,000 for drilling. All leases are on a 21 year term, renewable for 21 years at $1 per acre per year. Royalties run from 5 per cent on a small well up to 15 per cent on a well producing 6000 bbl per month.

Search Is Stepped Up

Permits and leases issued to date call for exploration work on more than three quarters of Saskatchewan's sedimentary basin. Where in the summer of 1952 there were 30 survey parties in the province, during 1951 there were 40 seismographic, one magnetometer, and 4 gravimeter surveys underway. The 241 permits issued up to November 1951 cover an area of 33,000,000 acres, while areas formerly under permit have been converted to leases covering close to half a million acres. At that time there were 49 wildcats drilled or drilling, with an average depth of over 5000 ft. The number of deep tests drilled in 1951 is expected to reach a total of 70.

Leaders in the Saskatchewan search are Tidewater, Socony-Vacuum, Royalite-Albercan, Husky, Sohio, and Shell of Canada. California Standard is pioneering in Manitoba, while across the International Boundary Shell Oil in Montana and Amerada in North Dakota are drilling test wells astride the deepest section of the Williston Basin. Others interested include Canadian Gulf, Sunray, Sun Oil, Bata Oils, Hudson Bay Oil and Gas, and Pan Western; while a Canadian company, Federated Petroleums is moving in on a half million acre block in Montana and Dakota.

The Saskatchewan boom has been greatly encouraged by the recent upsurge of activity in the Lloydminister area, where oil production for 1951 from 185 wells showed a 20 to 25 per cent increase over the previous year, and gas production a 15 per cent increase from 140 producing wells. The outlay in Saskatchewan for exploration alone totalled to about $20,000,000 in 1951, or double that of the previous year. In the coming year it is expected to exceed $30,000,000.

Tests Astride the Boundary

This oil prospecting program to delimit the Williston Basin in two Canadian provinces and two states embraces all types of field and structure found to date throughout the explored sections of Alberta. Last February, California Standard made Manitoba's first commercial discovery of oil 9 miles west of Virden, close to the Saskatchewan border, where a flow of 150 bbl daily of 30 deg oil on pump was obtained from the Mississippian at a depth of some 5300 ft. Two follow-ups nearby have turned out to be smaller producers and a fourth test is underway 60 miles to the southeast.

Following close on this find came Amerada's discovery in April from their Iverson No. 1 well 9 miles south of Tioga, North Dakota, which is 45 miles south of the Canadian border and 45 miles east of the Montana state line, in the deep mid-section of the Williston Basin. Oil was first found in the Upper Devonian at 10,500 ft. The well was then deepened to the 12,000 mid-Devonian, where a test showed production of 400 bbl of 53 deg oil and 3,000,000 ft of gas daily. Lack of a market for the gas caused this to be cemented off, and production at 275 bbl daily of light oil was continued from the upper zone where the gas-oil ratio approaches 720 cu ft per barrel.

Amerada has followed up this discovery with three more wells nearby; a flow of 3000 bbl daily of 40 deg oil was found from a 133 ft Mississippian pay zone in their Dilland No. 1 well, and 275 bbl of oil and 210,000 ft of gas from the Devonian at 8350 ft in their Bakken No. 1, while a fourth well, Risser No. 1 was

The Author

H. G. Cochrane is a member of the Engineering Institute of Canada. After spending his early years on irrigation development in Alberta and Saskatchewan, he went east to build a number of large hydro-electric power plants in Quebec and Manitoba. He became interested in oil development in the late thirties while making preliminary studies and estimates of oil pipe lines to Lakehead and the Pacific Coast.

During World War II he conducted economic studies on scarce materials and services for the Canadian Government. Returning to power development, he is presently with Power Corporation of Canada Limited at Montreal.

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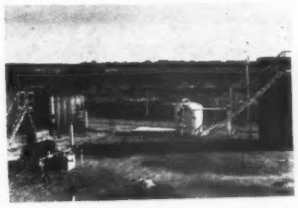

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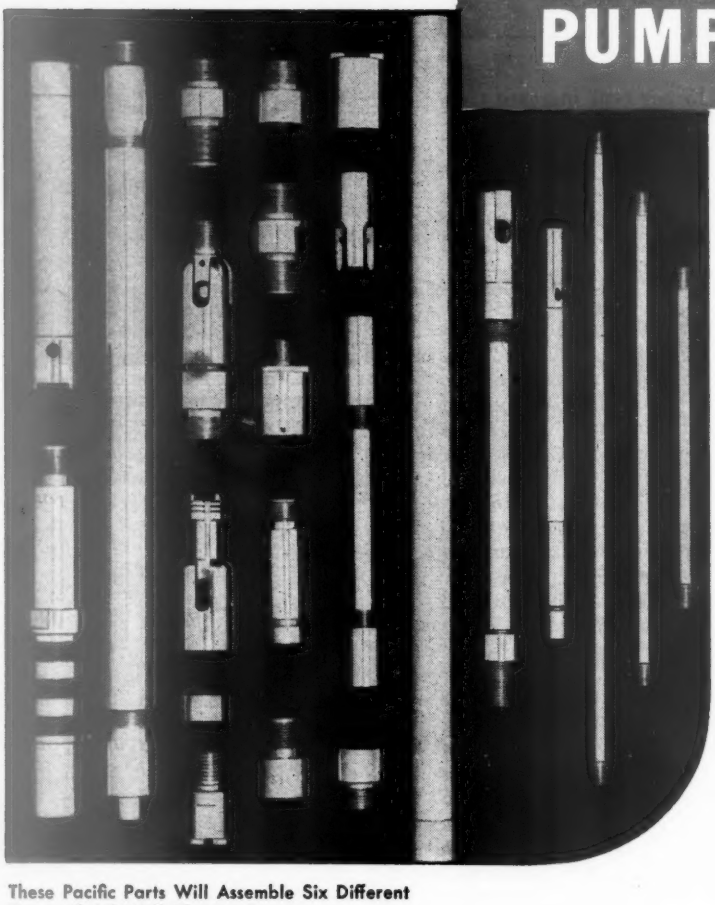

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spudded in September. Meantime in July Shell made a discovery in Eastern Montana near Richey, 90 miles south of the Canadian border due south of Moose Jaw, obtaining a flow of 2000 bbl daily or better of high gravity oil from the Madison lime at 7200 ft, in their Shell-Northern-Pacific No. 1 well.

Also in July, Socony Vacuum brought in a gas discovery at Tomkins, Saskatoon, 75 miles north of the International Boundary and 42 miles southwest of Swift Current. Their Tompkins No. 1 well showed a flow of 2,000,000 ft of gas daily from the Jurassic sand at 3650 ft. This was shut off in order to drill deeper to test the Ordovician.

But perhaps the most important find to date so far as Saskatchewan is concerned was the November discovery by Royalite-Albercan, 15 miles northwest of Kindersley and 120 miles southwest of Saskatoon. Their Albercan-Colville No. 1 well found heavy 14 deg oil and 10,000,000 ft of gas daily in a 60 ft pay zone of the lower Cretaceous formation at 2700 ft. A flow of 8 to 10,000,000 ft of gas was also obtained from the Viking sand at 2300 ft. Several more follow-ups are being drilled nearby.

Exploration Covers Wide Areas

Other discoveries have included the Husky-Phillips Eatonia No. 1 well 22 miles south of Kindersley, where a good show of light oil was found; and a fair show of light oil by Shell of Canada near Dahinda 60 miles south of Regina. Though commercial production is still questionable, these light oil discoveries have done much to add new interest in the surrounding area. California Standard added another success at year's end, 60 miles southwest of Brandon, Manitoba, with a light oil show at their Linklater No. 2 well. Most recent finds include Husky-Phillips' Brock No. 1 and 2, 100 miles southwest of Saskatoon with 18 to 40,000,000 ft of gas from the Viking sand; Socony's Roseray No. 1 well 25 miles north of Tomkins with 700 bbl daily of 24 deg oil from the Cretaceous; and Sohio's Elrose No. 1 well 90 miles southwest of Saskatoon with 7,000,000 ft daily of gas.

Other wildcats still drilling include Albercan's well 12 miles west of Maple Creek, and Tidewater's test 60 miles west of Saskatoon; the Quintana Melaval test 70 miles southwest of Moose Jaw; Bata Petroleum's test at Vera, 60 miles north of Albercan's discovery; Royalite's well 9 miles northwest of Smiley, which is 15 miles northwest of Kindersley; Hudson Bay's test at Weredale 25 miles northeast of Prince Albert; and Shell-Albercan's test near Govenlock. There have been several abandonments, noteworthy among which was Sohio's 10,000 ft hole near Wood Mountain in central Saskatchewan 14 miles north of the U. S. border, and 100 miles north of Amerada's Dakota discoveries, known locally as the "Big Muddy". Some 10 new tests were spudded in Saskatchewan during December, bringing wells drilling at year's

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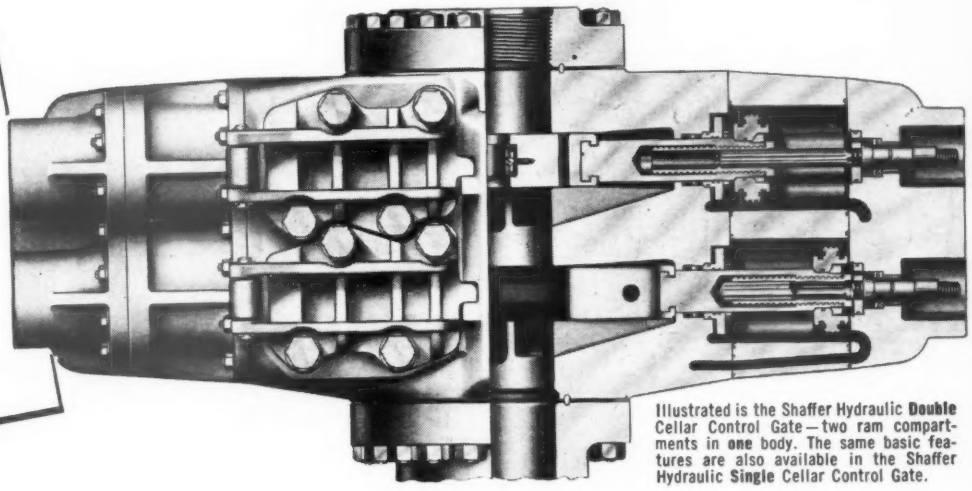
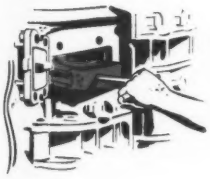


Illustrated is the Shaffer Hydraulic **Double** Cellar Control Gate—two ram compartments in **one** body. The same basic features are also available in the Shaffer Hydraulic **Single** Cellar Control Gate.



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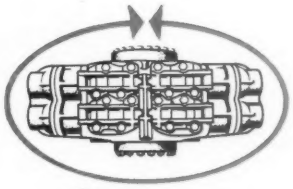
Changing rams in a Shaffer Hydraulic Gate is far simpler and quicker. Simply unbolt and open two doors, slide out the old rams, slide in the new—then close and bolt the doors. There's nothing to disconnect—and closing the doors automatically aligns rams for proper operation. Best of all, **complete ram changes can be made whether pipe is in or out of the hole!**



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SEALED DESIGN!

In Shaffer Hydraulic Gates all moving parts—including piston rod ram shafts—are completely enclosed within the gate body. There are no exposed moving parts to become wedged or damaged by objects falling into the cellar—nothing to become corroded by chemical or salt drippings. Even the locking shaft is non-rising—fully protected!

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The Shaffer Hydraulic Double Cellar Control Gate contains **two** ram compartments unitized into **one** body . . . and even in sizes as large as 13⅜" (12" series 900) **requires only 30" total height.** Smaller sizes even less!

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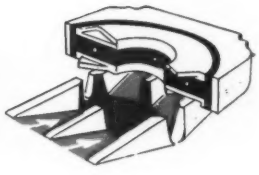
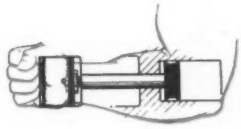


Compare

INTERNAL SAFETY!

With Shaffer Gates you don't have to worry about mud or sand interfering with free ram travel. The rams travel on high narrow guide ribs above the steeply-sloped ram compartment bottoms. Mud and sand quickly drain back into the well—with no detrimental accumulations to interfere with ram operation!



Compare

OPERATING SIMPLICITY!

Simple design means simpler maintenance, more trouble-free operation. Note how the operating cylinders in Shaffer Hydraulic Gates are **directly behind** the rams and operate through a rugged **one-piece** connection. No complicated multiple-element connections to wear or jam!

By making such a comparison you will readily see why these and still other important advantages engineered into Shaffer Hydraulic Cellar Control Gates make them, by far, the outstanding choice for protection against pressure emergencies. In fact, on every point essential to modern cellar control gate protection, this unit is unsurpassed.

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end to 30 in Saskatchewan and 7 in Manitoba.

Apart from the companies already mentioned, are two holding company operations sponsored by Anglo American Oils, Ltd., which is currently spending a quarter million dollars weekly buying up undivided half interest in minerals under Saskatchewan lands for which rights are under lease. Out of the acquisition of these rights have come two public companies; Gridoil has started a geophysical program in the Tomkins area. These are long term gambles on the Williston Basin based on 6¼ per cent gross royalty. They had five parties in the field last fall.

Drilling contractors report that severe climatic conditions in Saskatchewan give more trouble than drilling conditions, due to heavy snowfalls and intense cold. Little "crooked hole trouble" is experienced, due to softer formations than in neighboring Alberta — the upper shales are soft and unconsolidated. Shales in the Moose Jaw Basin vary in depth between 4500 and 5000 ft; the lime drilling, on the other hand, is slower than that in the Redwater and Leduc fields. Lack of water is often a problem, and drifting soils are hard on the equipment. Lack of efficient machine shops also presents a problem.

On the oil production front also, past Canadian records were upset in 1951. The 29,300,000-bbl output of 1950 has been topped by an estimated 47,700,000-bbl production for 1951, a gain of 63 per cent over the previous year. Peak daily production during the year rose to a new high of 168,000 bbl daily during October. Measured against Canadian consumption, all of this means that Canada produced less than a fourth of national requirements in 1950, and almost a third of her growing oil consumption in 1951.

This sharp increase in production is of course due to 1951 being the first full year of operation for the big 30-in. Interprovincial pipe line from Edmonton to Lakehead at Superior, Wisconsin, which also serves other refining centers such as Moose Jaw, Regina and Winnipeg. During the coming winter, due to installation of more pumping equipment, as well as larger storage facilities at Superior, throughput will average 125/130,000 bbl daily, or 50 per cent more than the average during the winter of 1950-51.

But *potential* Canadian production, if matched by some expansion in refining and transport facilities, would enable Canada to satisfy about half of present Canadian consumption, or some 75,000,000 bbl annually. In another year's time at the current rate of new well completions, potential production should be close to 100,000,000 bbl per year. By that time increased marketing facilities on the prairies and via the pipe line to Lakehead, should support a production of some 75,000,000 bbl yearly, a gain over 1951 of 50 per cent.

New Outlet to Pacific Coast

With the realization that prairie and Eastern markets alone could not be developed fast enough to stimulate further development, pressure to provide an outlet to the Pacific Coast has been insistent. This finally resulted in an announcement last December that, with the approval of Canada's Board of Transport Commissioners, a 24-in. oil pipe line, 700 miles long, would be built at a cost of $82,000,000 from Edmonton to Vancouver across the mountains via Jasper, Kamloops, Merritt, and Hope.

Planned for an initial capacity of 75,000 bbl daily, it could be raised by the addition of further pumping units to a capacity of 200,000 bbl daily if and when Alberta oil could be marketed in the Pacific Northwestern states. The present Vancouver market would be limited to around 40,000 bbl per day, possibly even to a mere 15,000 bbl at the outset. But ultimately there should be a market in Washington and Oregon states for somewhere between 250,000 and 300,000 bbl per day within about 4 years, as refining facilities are built up. The pipe line is scheduled for completion in two years.

Thus by 1954 the opening of these markets for Alberta oil could mean a total productive output approaching a rate of 100,000,000 bbl yearly, while by 1955 markets and marketing facilities may well have come close to catching

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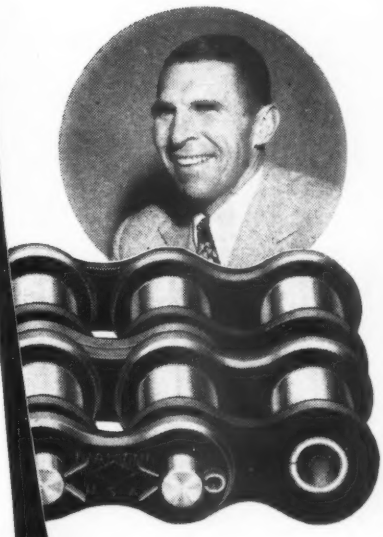

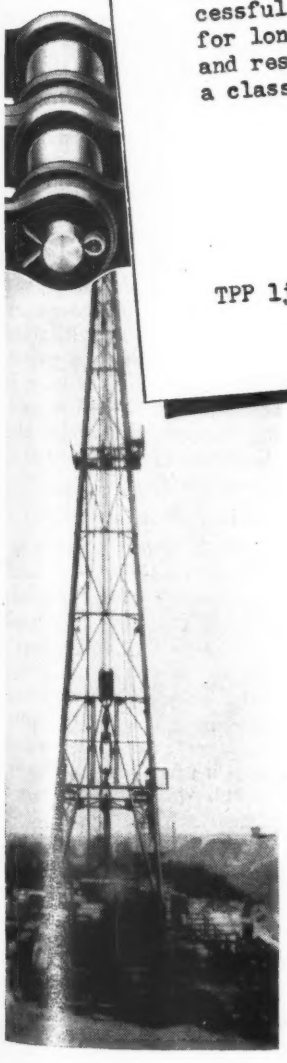

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up with potential production then probable of 160,000,000 bbl per year. Canada would then have equated potential production with national consumption, on balance, with exports to the Pacific states balancing imports to Eastern Canada.

Confidence in the Future

This represents very rapid development, however it is measured. It is the direct result of the Alberta Conservation Board's drilling regulations, which were designed to assure a rapid development of that Province's petroleum resources. The pressure of severe proration on a constantly accelerating volume of potential production inevitably must result in the opening up of more distant markets, in a collapse in the form of lease cancellations and capping of wells, or in a wide relaxation of Conservation Board regulations.

The attainment of new and bigger market simplifies, too, the availability of steel supplies for drilling and pipe lines. But the magnitude of the investment involved, estimated to date at well over a billion dollars, and Canada's urge to self sufficiency in oil, as well as the importance of oil defense-wise, all provide strong assurances that these needed markets will be found and served. It also implies the need for a steady continuance of recent discoveries of more major pools. But that does not worry oil economists and geologists who have studied this phase. They point out that Alberta's oil development history shows that, of the 37 fields proved between 1947 and 1950, four of these or 11 per cent of the total have shown in excess of 50,000,000 bbl of recoverable reserves. Texas, between 1900 and 1950 proved up more than 2500 fields, and only 5 per cent of that total turned out to contain 50,000,000 bbl or more. When a new oil region compares well at this early stage of its development, they argue, it is reasonable to believe it will develop reserves several times larger than the 1-7 billion barrel reserve proved to date. Yearly increments to this reserve have averaged 400,000,000 annually. In 1951, 600,000,000 bbl were added.

New Proration System

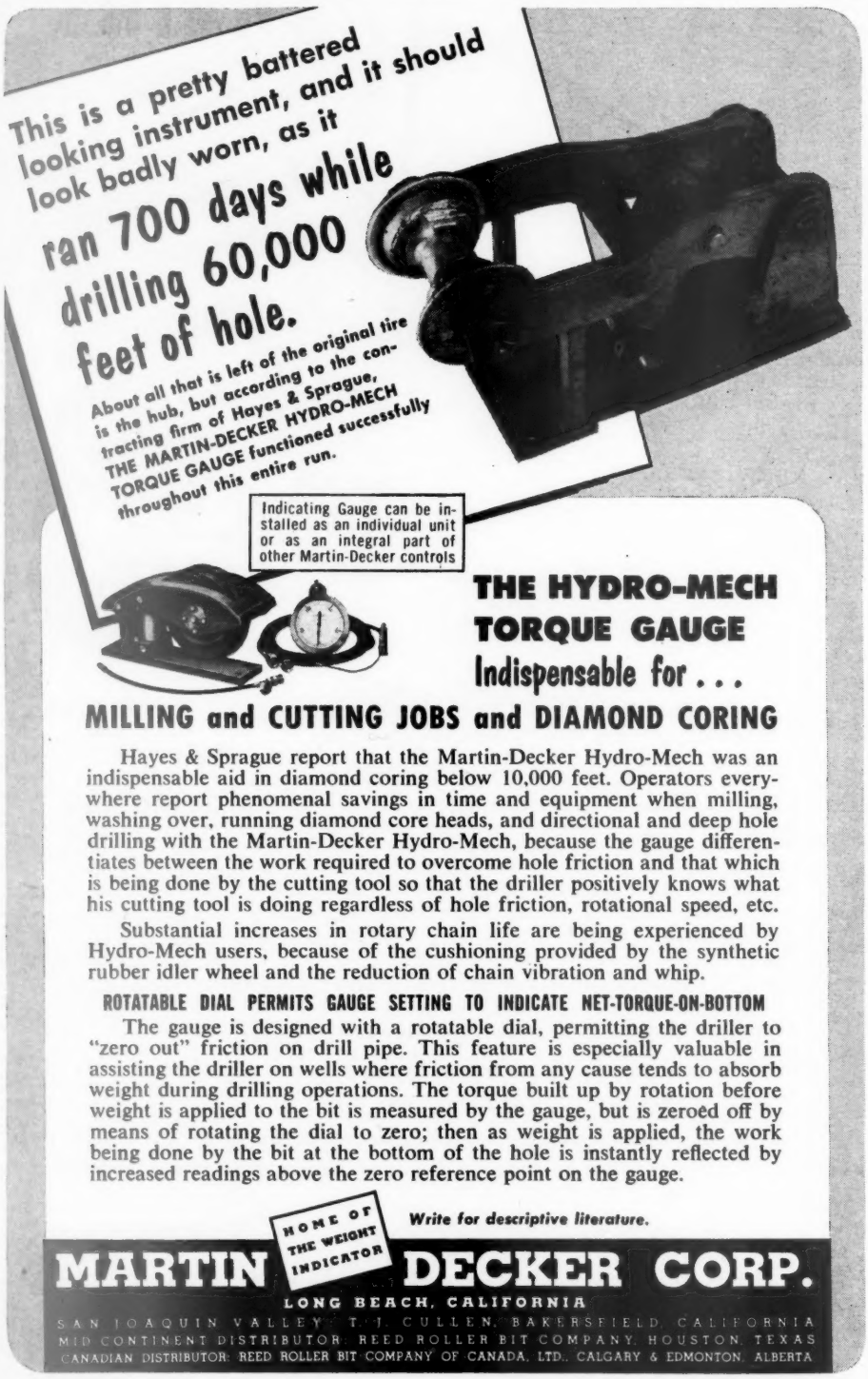
A year ago, on the eve of a sharp increase in production due to the opening of the Interprovincial Pipe Line to Lakehead, Alberta's Petroleum Conservation Board introduced a new technique of production control, designed to accomplish a fair distribution of available markets between all fields. This system of control, called the "rateable take" has now superseded the market proration system previously in effect.

Under the new system, allowable production is fixed monthly for the province after purchasers have nominated their requirements of various crudes in terms of barrels per day. The total is divided among light, medium, and heavy crudes, and this sets the pattern of allocation between the various fields. The number of wells in each are estimated a month in advance. Each pool is then allotted crude production, in relation to the number of wells times maximum efficient rate of production for each well, whichever is the smaller, and based on floor and depth factors. This "economic allowance" for each pool is then deducted from the total allowable for that particular type of crude, and the balance is allocated among the pools in that category according to their potentials. The final pool allowable is then prorated among all the wells in the pool.

Operating Problems

This winter, markets will take an average of 130,000 bbl daily, half as much again as last winter. But the number of producing wells has also increased about 50 per cent over the same period, and price cuts of about 15 per cent have intervened. Though producers are not suffering much of a drop in gross earnings, this, nevertheless, illustrates what a short time it takes for productive potential to catch up with increased handling facilities.

Generally speaking, gas-oil ratios and bottom hole pressures in producing fields are holding up well. In some cases the ratios are actually increasing. The Redwater field is an exception. Here are close to 700 producing wells, up sharply from 234 a year ago. There is still a large area to develop on the west side of the field. By last August the alarm-


This is a pretty battered looking instrument, and it should look badly worn, as it
ran 700 days while drilling 60,000 feet of hole.
About all that is left of the original tire is the hub, but according to the contracting firm of Hayes & Sprague, THE MARTIN-DECKER HYDRO-MECH TORQUE GAUGE functioned successfully throughout this entire run.
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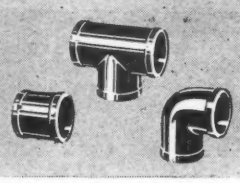

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ing drop in bottom hole pressure showed the necessity of taking secondary recovery measures. Last summer it was definitely shown that there was an effective water drive, and this has brought about the decision to undertake a fully integrated water flooding project, which will rank as one of the largest projects of this nature ever undertaken.

Natural Gas Export Expected

During the past two or three years, interest in natural gas has been rivalling the interest in oil. A Royal Commission was appointed back in 1948 by the Provincial Government, to advise what proved gas reserves were available in the province. It was also instructed to assess what the province's domestic requirements of gas would be over the next thirty years. Following the publication of its report, applications for permission to export various quantities of surplus gas to Winnipeg, Vancouver, the Pacific Northwest States, and even to Eastern Canada, were submitted to Canada's Board of Transport Commissioners at Ottawa. While the Province alone will determine when gas may be exported, the Transport Board has the final authority for comparing the applications and the markets involved, and for deciding which pipe line applicants get permission to build the pipe lines and serve markets.

A year ago the Alberta Government, following two years of Conservation Board hearings, announced that it favored export the moment adequate reserves beyond the province's 30 year requirements, were shown to exist. At the same time incentive regulations were issued to spur gas exploration. Since that time many new gas fields have been discovered, bringing the estimated marketable reserves up to some 8 trillion cubic feet. This compares with estimated 30 year domestic requirements of 3.2 trillion cubic feet. Thus reserves are now some 2½ times the province's 30 year needs, with reserves being added to every week. The Conservation Board is now making a final study and an appraisal of the situation. It is expected that an announcement to the effect that export will be permitted will not be delayed beyond late March.

All of these oil and gas developments are providing intense stimulation for the whole Canadian economy. Not the least of its effects is the reduction in the outlay of U. S. funds to the extent of $150,000,000 yearly for the purchase of imported petroleum products. Further stimulation will come from the lusty young petrochemical industry now growing up in both Alberta and in parts of the Central provinces which is based on Canadian oil and gas. Presently the seventh largest oil producing country, Canada's output is only exceeded by the United States, Venezuela, Russia, Saudi Arabia, Kuwait, and Mexico. The day is already in sight when Canada may move up to take her place as one of the three greatest oil producing nations of the world. * * *

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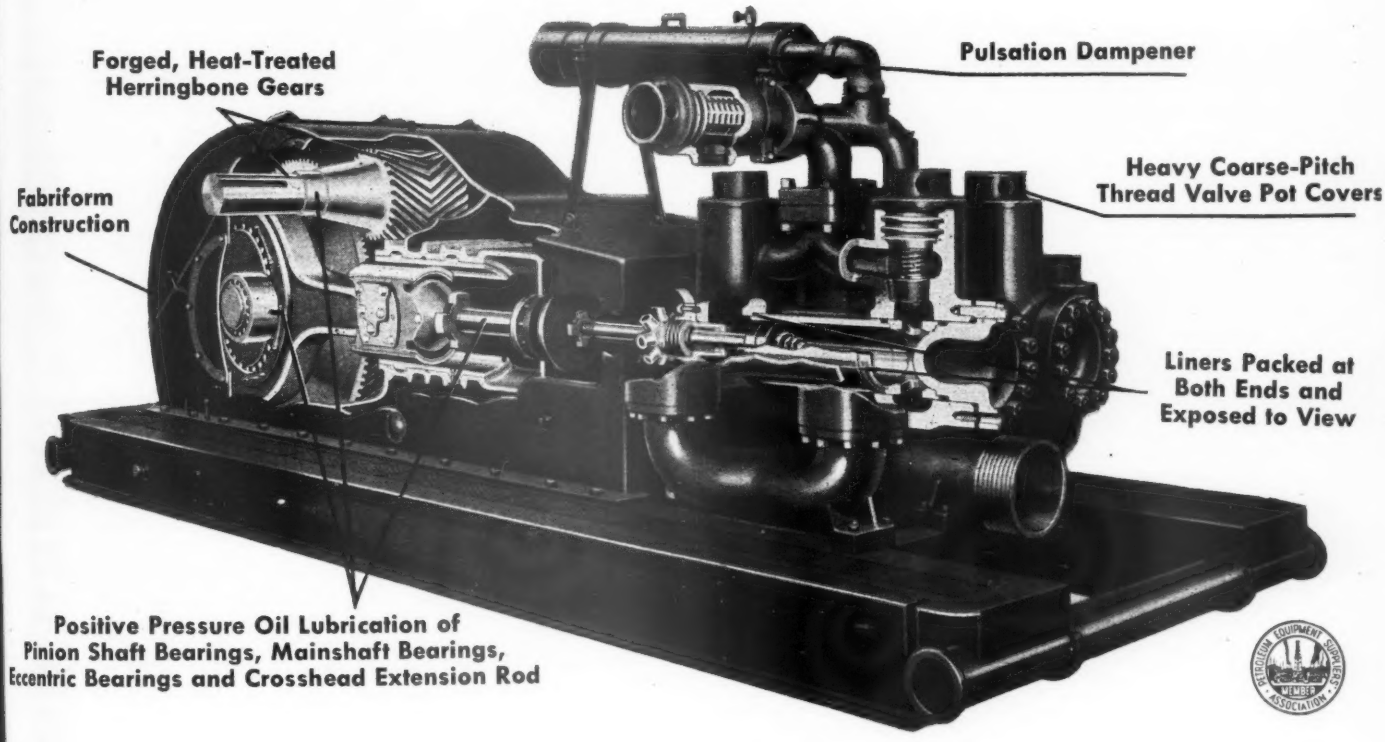
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SPRABERRY

Some Microscopic Characteristics

Petrographic studies of four sections, which are assumed to be fairly representative of much of Spraberry trend

W. A. WALDSCHMIDT

THIS article, which is based upon petrographic studies of only four thin sections, is brief but it is hoped that the information presented will add some useful data to our present knowledge of the Spraberry. The samples studied are from the upper Spraberry, the base of the lower Spraberry, and the shale section at the base of the Spraberry.

Thin section No. 1, from the upper Spraberry in DeKalb No. 1 TXL, Section 17, Block 37, T-4-S, Midland County, Texas, depth 7171, is a siltstone. The dominant mineral is quartz. The grains are angular, are moderately well interlocked throughout the mass but in some parts of the section they are separated by small amounts of clay. Some secondary quartz is also present. On the basis of grain counts, in ten fields selected at random, quartz was estimated to constitute about 89 per cent of the rock. The majority of the quartz grains range in size from 0.017 mm to 0.055 mm. The long diameter of the largest quartz grain observed was 0.125 mm.

Dolomite makes up about 8 per cent of this rock and is distributed uniformly throughout the mass. Most of it is present as small rhombohedrons which range in diameter from 0.004 mm to 0.015 mm. A few dolomite aggregates are present and the largest of these is 0.267 mm in diameter.

Feldspar, both orthoclase and acid plagioclase, makes up about 2.2 per cent of this rock. The grains are angular, approximately the same size as the quartz grains, are uniformly distributed throughout the mass, and are practically unaltered.

Other accessory minerals present are muscovite, sericite, zircon, apatite, and chlorite.

Thin section No. 2 is from the upper part of the Spraberry in the Tex-Harvey field, exact well data not available, and has been classified as a shaley siltstone. In this sample quartz is the dominant mineral and constitutes about 88 per cent of the mass. The grains are angular and nearly all are separated with small amounts of clay or sericite. The majority of the grains are less than 0.0576 mm in diameter.

Feldspar (orthoclase, plagioclase) is present in small amounts, about 2 to 3 per cent, and is distributed quite uniformly throughout the rock. The grains are angular, about the same size as the quartz grains, and show only slight alteration to sericite.

Anhedral grains and poorly developed rhombs of dolomite are scattered sparingly and unevenly throughout the rock. The majority of these are less than 0.057 mm in diameter. The amount of dolomite present is estimated to be about 8 per cent.

In the core sample very thin shale streaks give the sample a laminated appearance, however, in thin section, under the microscope, the shale streaks are not as well defined, are short and are not continuous across the section. The shale streaks are the only good evidence of bedding. Within the shale streaks are minute spheres of pyrite or marcasite which range from 0.0034 to 0.0077 mm in diameter. A few of these spheres are also scattered sparingly throughout the main mass. Other accessory minerals present in small amounts are zircon and titanite.

The Author

William A. Waldschmidt, consulting geologist and petrographer in Midland, Texas, is a graduate of South Dakota School of Mines; obtained his MS from Massachusetts Institute of Technology, and PhD from University of Colorado. He served as a subsurface and field geologist for Midwest Refining Company in the Rocky Mountain region from 1927 to 1929. From 1943 to 1945 he was geologist for Case, Pomeroy and Company, Inc., working in the San Juan Basin, New Mexico, and Permian Basin, New Mexico and Westex. Before going to Midland in his present capacity he served for five years as geologist for Argo Oil Corporation in the Permian Basin, New Mexico, and West Texas.

Thin section No. 3, from the base of the lower Spraberry in the Greenbrier No. 1 McAlister, Section 40, Block 37, T-1-S, Midland County, Texas, depth 7878 ft, is a dolomitic siltstone. Quartz is the dominant mineral and constitutes about 84 per cent of the rock. The grains are moderately well interlocked, and some secondary quartz is present. Some of the quartz grains are elongated and have a maximum length of 0.096 mm, however, the diameter of the majority of the grains ranges from 0.038 mm to 0.058 mm.

Dolomite is an important constituent in this rock because the amount present is approximately 13 per cent. Most of the dolomite occurs as grains and aggregates with irregular outlines, but some individual rhombs are also present. The aggregates range in diameter from 0.096 mm to 0.19 mm. Many of the irregular dolomite areas are of single optical orientation, but others are made up of grains with different optical orientation. Individual dolomite rhombs, some of which are in the aggregates, range in size from 0.0038 mm to 0.038 mm. The relationship of the dolomite to the quartz grains indicates that the dolomite has filled the original voids in the rock.

Other accessory minerals present in this sample are feldspar (plagioclase, orthoclase, and a trace of microcline), muscovite, sericite, kaolin, zircon and apatite. The feldspar grains are angular, about equivalent in size to the quartz grains, of relatively uniform distribution throughout the mass, and in part show but slight alteration to kaolin and sericite. Feldspar is estimated to make up about 2 per cent of the rock.

Muscovite and sericite are estimated at less than 1 per cent of the rock. The largest blades, up to 0.115 mm in length, are considered to be muscovite of original deposition, whereas the very fine micaceous material, present in small amount in the feldspar and between some of the quartz grains, is considered to be sericite which, in part, is of secondary origin. The sericite and muscovite blades are of random orientation. Only a few of the muscovite blades have been distorted by mechanical compaction. Minute crystals of apatite and

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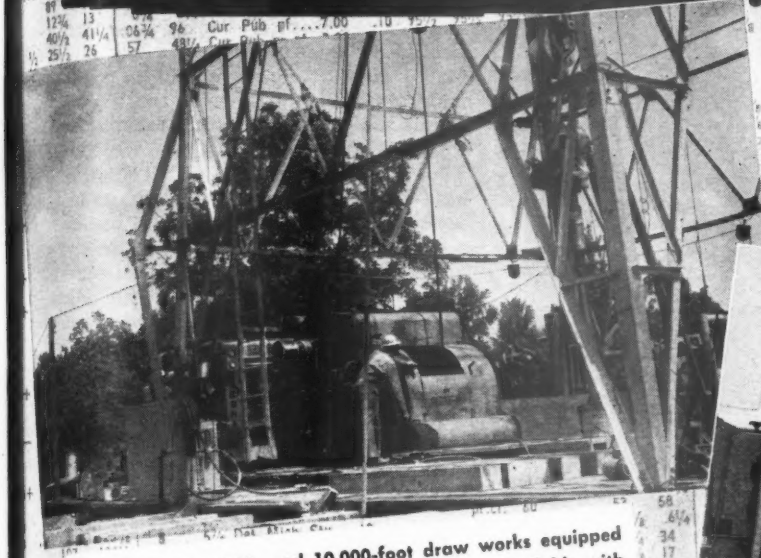

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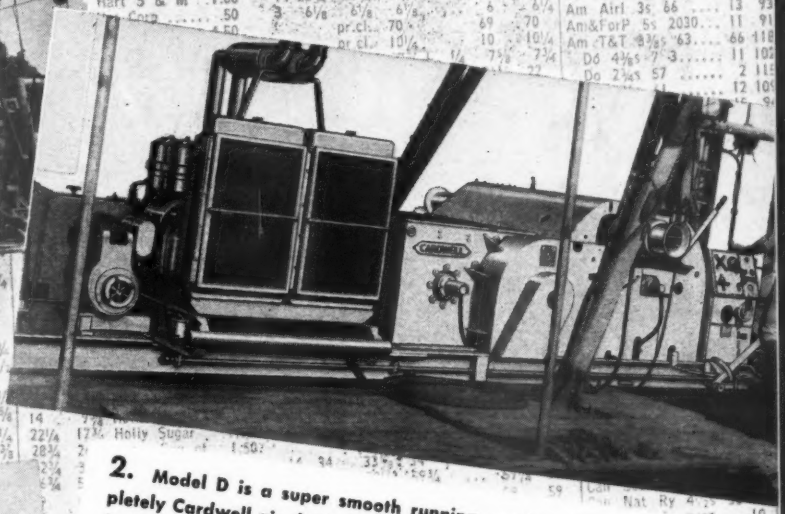

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zircon are present only in very small amounts.

Thin section No. 4 is from the shale section at the base of the Spraberry in the Greenbrier No. 1 McAlister, Section 40, Block 37, T-1-S, Midland County, Texas. This is a silty shale which is massive, compact, very fine textured, and black in color. Broken surfaces, parallel to poorly developed bedding planes, show numerous minute specks of mica. Quartz is an essential constituent of this shale. The grains are evenly distributed, are angular, and range in size from 0.0038 mm to 0.038 mm. The main base mineral of the shale appears to be sericite. Some minute muscovite blades are present and some of these apparently have been distorted by mechanical compaction. A few dolomite grains, ranging in size from 0.012 mm to 0.029 mm are unevenly distributed throughout the mass. None of these dolomite grains have good rhombic outline. Also included in the shale are tiny spheres of pyrite or marcasite which have a maximum diameter of 0.053 mm. These spheres are confined largely to the bedding planes.

The samples described above should not be assumed to be typical of the entire Spraberry, however, they are believed to be fairly representative of much of that formation. On the basis of grain size, the first three samples are classified as siltstones because the majority of the grains are less than 0.0625 mm (1/16 mm) in diameter. Undoubtedly other parts of the Spraberry are coarser than the samples described above, and if so, if based on grain size, should be classified as very fine sandstone or even fine sandstone if the grain diameters are within the limits of 0.0625 mm to 0.125 mm and 0.125 to 0.25 mm respectively. Sample No. 3 is classified as a dolomitic siltstone because dolomite is present in excess of 10 per cent and is therefore considered to be an essential mineral.

The subdivision of clastic grains on the basis of size into silt, very fine sand, fine sand, and coarser types is, of course, an arbitrary subdivision; consequently, some geologists may use slightly different size limits than those given above.

* * *

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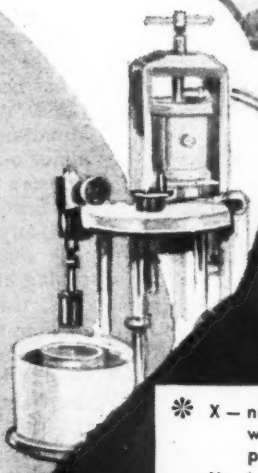

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Hollow Sucker Rods Aid Cleaning and Treating Techniques

RICHARD SNEDDON*

A COMPARATIVELY recent innovation in the conditioning of producing wells and one that is proving to be a really consequential development is the hollow sucker rod. Up to the moment its principal application has been in the cleaning of wells that tend to become plugged by paraffin deposits. But its prospective employment for a number of other similarly desirable functions seems imminent.

There is actually no reason why solvents, chemicals, corrosion inhibitors, and all sorts of agents and reagents couldn't be conveyed far down into the hole and without interruption of the pumping process, and that is exactly what the hollow sucker rod makes possible. The idea of a hollow rod emanated from one of these casual after-lunch discussions that quite frequently give birth to distinctly worthwhile suggestions. In this instance, Sam Gilliard, Ventura engineer and equipment manufacturer, and Ray Reese of Fillmore Improvement Company, were discussing the dewaxing problem over their dessert one day a few years ago. Sam remarked that if there were just some way to get the hot solvent down below the starting point of wax deposition, a much better job of dewaxing the well could be done. Ray immediately suggested, "What about a hollow sucker rod?"

It was just as simple as that, but in the meantime, the hollow sucker rod has caught on in no uncertain manner, and it has been performing a service of real value. It was first used in the South Mountain field in 1949 by one of the major oil companies and was so successful even in the initial experiment, that it has become standard practice with that company. Ray Reese and Sam Gilliard took some 1⅛-in. O. D. by ⅜-in. I. D. tubing and to them hand-welded hollow pins, using standard API ⅞-in. couplings to tie them together.

The preliminary fabrication was done in a little shop in Fillmore adjacent to the South Mountain field, after which the rods were run in one of the most severely paraffined wells that could be found in the area. In the course of 19 months this well was dewaxed some 27 times with varying amounts of solvent oil at varying temperatures, the purpose, of course, being to determine the most desirable quantity of oil to use and the ideal temperature and circulation rate. After each test, the rods were pulled and examined meticulously, and on the basis of these tests a tentative routine was set up.

By the middle of 1950 a servicing organization had been formed,[1] and a first order of significance had been received. It was for 90,000 ft of hollow sucker rod, and this naturally had the effect of instilling confidence in the officers of the new company. They studied the needs of the situation carefully, ordered 1035 steel tubing from a nationally known manufacturer for the body of the rods and alloy steel for the hollow pins. The joints were 30 ft long and comprised of 1⅛-in. OD by ⅝-in. ID tubes. Particularly gratifying was the fact that one of the most enthusiastic patrons was a major oil company, always a heartening circumstance to a new oil equipment or service organization. Approximately one year later, another major oil company installed 4800 ft of hollow sucker rod in a well in the Zaca Creek area of California for the purpose of injecting detergent into low gravity crude to reduce its viscosity so that the sludging effect would be minimized and the pumping pressure simultaneously lowered.

Meantime, the knowledge of hollow sucker rods and their prospective and potential use has spread. The original endorsers still continue to use them and in increasing quantity. New users are springing up daily, and there seems little doubt that this departure in equipment design satisfies an urgent need and at the same time introduces hopes of further economies and efficiencies that practically guarantees its expanded use in the future. The installation of hollow rods, combined with rational dewaxing procedure and servicing, would seem to portend for many fields prolonged production at increased rates, and these are considerations that have a genuine appeal to producers of paraffinic crude.

In operation, the routine is somewhat simple: After the maximum depth of paraffin deposition has been determined, hollow sucker rods of the combined length to reach this depth are run in the hole, usually with a ball check value set at the bottom to prevent any back flow of oil. The complete string from the check valve to the surface is hollow, including the polished rod. On top of the polished rod is an adapter for pulling the well when necessary. Standard rod tongs and elevators are adequate to take care of the entire pulling operation, and the use of hollow rods does not impose any special requirements as one might expect. The adapter on top of the polished rod includes a swivel joint and high pressure valve suspended with a high pressure nipple and one half of a union, which in turn is connected to a 1-in. flexible, high pressure line leading to the dewaxing unit.

The dewaxer consists of a truck-mounted 50-bbl, portable tank for carrying the solvent oil. A gas heater is used to heat the oil to the required temperature. It is circulated through the heater by means of a 1¾-in. high pressure pump. The entire unit is portable and

*Pacific Coast editor.

[1]Gilliard Specialties, Ventura, California.

EXCLUSIVE

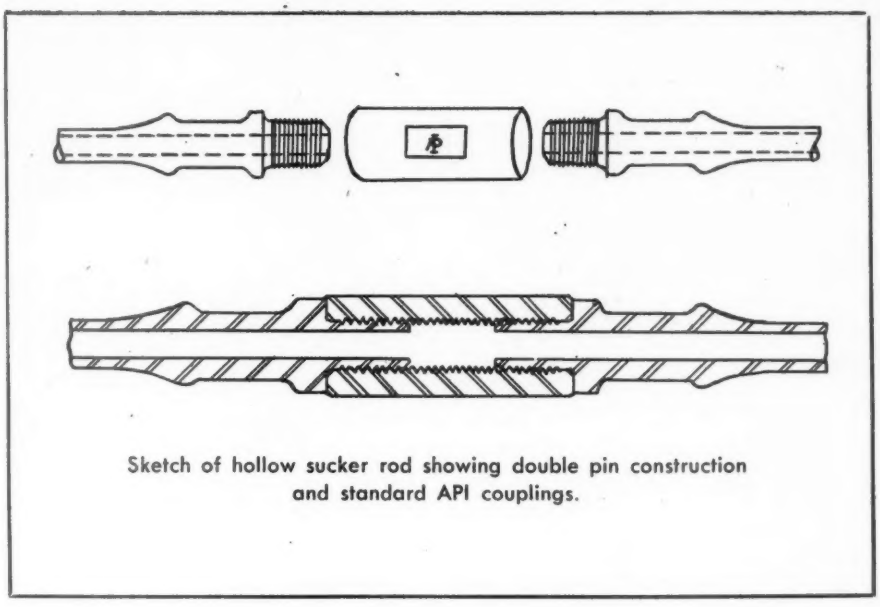
has been designed specifically to perform the dewaxing operation. It is completely safe in operation, having as integral parts of the total assembly—a flow meter, thermometer, and such check valves as are necessary. The quantity of oil circulated at any precise temperature and pressure may be recorded if desired.

One of the most attractive features of the process is that the solvent oil is pumped into the well and the total operation is completed without any cessation or slowing down of the well pump. The solvent oil is introduced at a temperature of approximately 80 F and heating is continued at such a rate that by the end of 20 minutes it has reached 200 F. Normally, 12 bbl of oil is sufficient to clean the annulus and flow-line on each well, and a period of one hour is time enough to complete the dewaxing job on an average well. In some instances, however, it has been found desirable to circulate hot oil through the flowline for some time prior to running it down the well. The annulus is then cleaned in the usual manner, and at the conclusion of this operation the hot oil is again circulated through the flowline.

The hollow sucker rods and the dewaxing technique can reduce approximately 75 per cent of the normal cost of pulling the rods and stripping off the wax. The system is operable without the necessity of shutting down the well pump. It minimizes wear and tear on the rods both by removing the wax and by eliminating the necessity of periodic pulling jobs. The loss of production due to waxing can be kept down to negligible proportions by cycling hot oil at regular intervals and before the wax has had time to accumulate to any disturbing degree. And, of course, its ultimate effect is in general to reduce equipment maintenance and personnel, hence to lower lease production costs.

The firm that holds the patents operates either as a service organization, taking care of the entire process on a pre-arranged cost basis, or as a product manufacturer in which case the hollow rods are sold outright to the operator. Although so far the hollow rods have been used exclusively for dewaxing, they appear to offer a means of carrying on equally effectively other common production operations. For example, they would seem to simplify the spot injection of chemicals for various purposes. By running the hollow rods to hole bottom, they might be used to circulate hot oil for the purpose of melting and dissolving wax from the liner perforations, thus removing in some instances a total, and in others a partial impediment to flow from the producing formation.

The hollow rods could be used to inject water or other fluid that by agitation might free a bottom hole pump from sand or remove a sand plug from the hole itself. They could be employed to simplify the process of acidization; to inject demulsifying agents under certain conditions and thus cut the cost of dehydration; to eliminate macaroni string in asphaltic-base oil wells requiring the injection of hot oil for production. These are some possible applications that suggest themselves readily. There are, no doubt, many others that will develop with further experience, and the modification of the equipment itself may eventually bring even wider usage.



Sketch of hollow sucker rod showing double pin construction and standard API couplings.

The maximum recommended string depths at the present time are from 6500 to 7500 ft with polished rod loads in the neighborhood of 15,000 to 17,000 lb. One operator is currently dewaxing satisfactorily with a 4800-ft string in the injection well. The service company is supervising 20 sucker rod strings for another operator, and on the basis of experience to date, estimates that one man can normally dewax 8 wells a day if the wells are reasonably close together. As a matter of fact, on the lease already mentioned with 20 wells, it takes the operator two days to complete the dewaxing process on them all, and this is done once a month. One of the service trucks shown in the accompanying illustration can comfortably service 240 wells a month on full time, that is, one cleaning job for each well once a month, which is all that is normally required to keep wax depositions down to relatively harmless proportions.

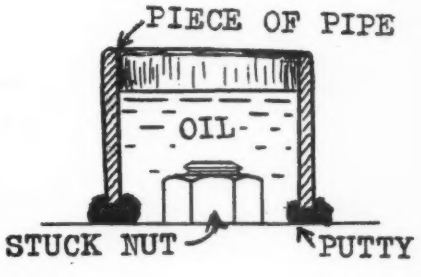
It has been found that crude oil produced in certain areas of the Ventura district are of paraffin base, and the wax in solution is precipitated on rods and tubing as the well fluid rises to the surface. If this wax is not melted or scraped from the rods and annulus at 30-day intervals, the tubing becomes completely plugged by the deposit and production ceases. With the use of hollow sucker rods to permit circulation of hot oil down inside the rods and up the annulus, the wax accumulation has been kept down satisfactorily, inexpensively, and with a minimum of labor, and the wells have produced without interruption. It is in this area that the 20 wells already referred to are located and preparations are now under way for the equipping of 40 additional wells with hollow rod in the same manner for the same purpose.

The introduction of mud into the bore hole through the drill stem and the bit without stoppage of the drilling process has been so long accepted practice that we don't even think of it now as being particularly clever. The hollow sucker rod in production practice seems just as rational, and there is little doubt that it will play an increasingly important part in the preservation of equipment and the more efficient lifting of oil in many future pumping wells. In conclusion, it might be noted that while the hollowing of the rod reduces the tensile strength, the tubing actually used has an adequate safety factor for pumpings from 6000 to 7000 ft and when greater depths are contemplated resort will be made to the use of alloy steel tubing. * * *

LOOSENING RUSTED NUTS

The accompanying sketch shows how to place a small "tank" of oil around a nut that is badly rusted. In this way you can give the rusted threads a thorough soaking.

As indicated, a piece of pipe serves as



the oil reservoir. A ring of putty or modeling clay can be made to serve as a seal between the pipe and the lower surface so that the oil won't leak out. In fact, if no piece of pipe is available, and if enough putty or clay is at hand, you can make the reservoir entirely of the putty or clay, without the pipe. The important thing is: Submerge the nut in the oil.—WFS.

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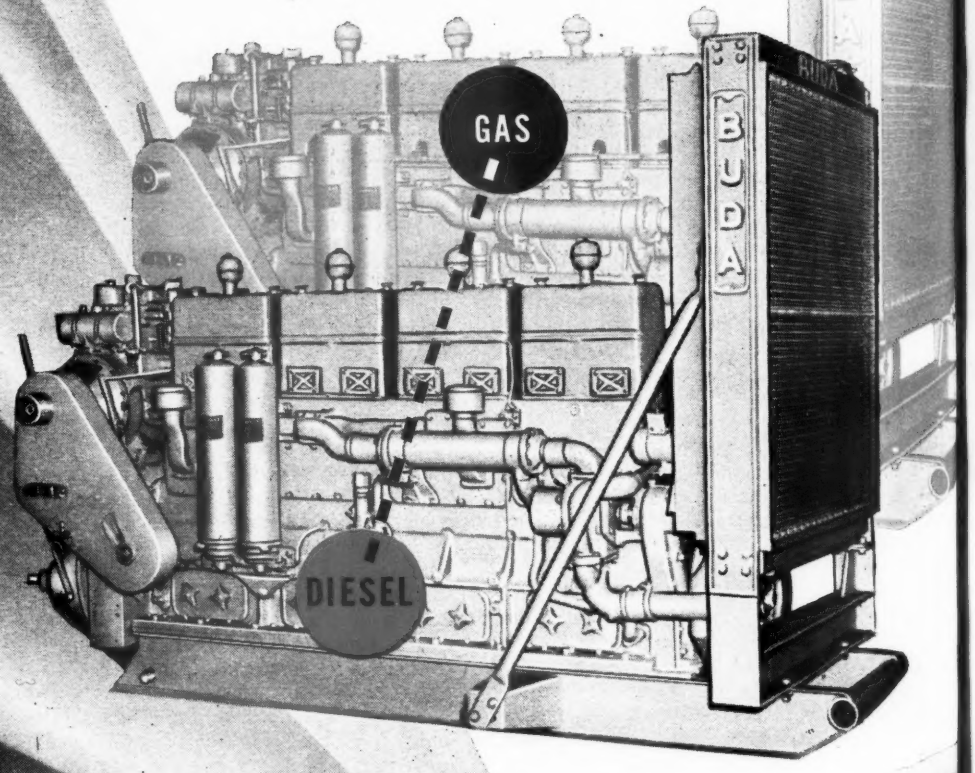

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Natural Water-Drive Conditions in Placedo

High oil recoveries in this Texas field are due to very active water drive. Many Gulf Coast fields experience the same intensity

S. F. SHAW

THERE are many oil fields along the Gulf Coast of Texas and Louisiana in which production of oil is accompanied by an active natural water drive of varying degree of intensity. Several fields of this nature are now being exploited along the Catahoula-Frio trend from Wharton County to Jim Wells County, Texas, and it is likely that other such fields will be found between and beyond these limits.

An example of such a reservoir is the Placedo field, Victoria County, Texas, where the water drive is exceedingly effective. This field was discovered in April, 1935, when F. A. Gillespie and the Superior Oil Company completed Henderson-Pickering No. 1 at 6005-6019, which flowed 240 bbl of 34.5 API oil through 5/32-in. choke[1]. The principal oil producing sand was discovered in June, 1935, by Costa Oil Company Schovajsa No. 1 at 4779-4785 ft in the Heterostegina. The first good producing oil well in the 4800-ft sand was that of E. L. Smith Henderson-Pickering No. 1, which was completed in July, 1935, at 4777 ft, making 160 bbl per day. As of September, 1936, some 80 wells had been drilled in the field, of which 60 wells were producing from the 4800-ft sand, and 23 wells were then making from 2 to 60 per cent water. Thus water became a factor in the early life of this field. A third sand producing only gas was discovered by Mortex Mitchell No. 1 in May, 1935, at 5273-5335 ft with thickness of approximately 35 ft[2]. This gas sand has been an important factor in carrying on the activities of lifting oil from the 4800-ft oil sand after natural flow ceased.

Wells in the main 4800-ft area of the Placedo field have been spaced on basis ranging from 10 to 20 acres per well. This article refers especially to an area where the spacing is on basis of approximately 15 acres per well, which was due, perhaps, to the general shape of the ownership acreage of the land in this particular area, where wells are situated close to the lower contours of the oil reservoir and where water has made its greatest influx.

Most of the wells flowed naturally when initially completed, but one after another has been invaded by water. With gas at pressure greater than 2000 lb available in the 5300-ft gas sand, which underlies practically all the 4800-ft oil sand, it was only to be expected that gas from the underlying gas zone would be utilized to lift the oil and water produced from the oil zone. At the time when water began to invade the 4800-ft horizon, the price of oil was low and had it been necessary to install compressor plants at that time for carrying on the lifting operation it is likely that several of these wells would have been abandoned. Some of the down-dip wells were placed on the pump, but several of these pumping wells were abandoned or subsequently placed on gas-lift when it became evident that the quantity of fluid necessary to be lifted in order to produce the oil allowable was much beyond the capacity of the pump.

Reservoir pressures have remained comparatively high at Placedo from the early days of production, and in wells at the outer edge of the productive zone, pressures are almost as high at the present time as they were when the wells were first completed, yet in some of these wells the sand surrounding the wells is of such nature that large volumes of fluid do not find entrance to the well bore even though they will fill up close to the surface when shut down for a few days.

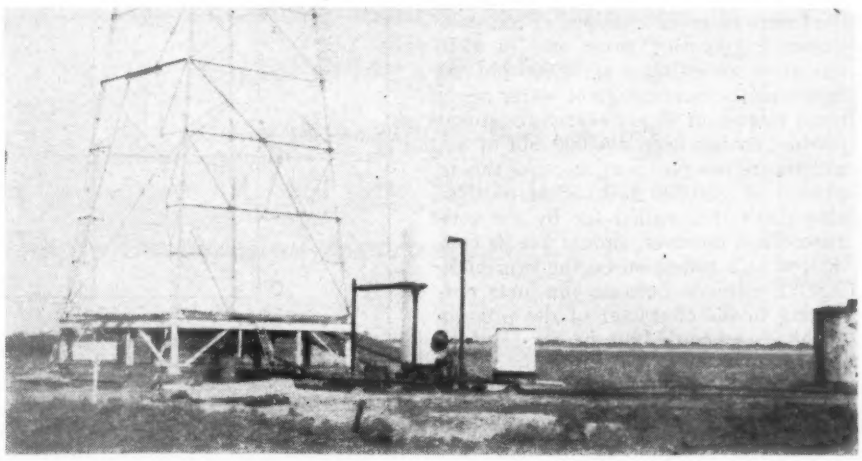
This article describes a group of leases on which eight wells were completed. These wells are surrounded on three sides by other leases with wells of similar character. It has been the endeavor to produce these wells in such a manner that production of oil would be maintained as near as possible to the allowable. In the early years of operation it was not apparent that this effort was utilizing the active water drive to good advantage in improving the drainage condition surrounding the immediate vicinity of the well, or in preventing the movement of oil, so far as possible, to wells higher on the structure. This upward movement of fluid toward wells higher on the structure is to be expected,

The Author

S. Fred Shaw, gas lift consulting engineer in San Antonio, Texas, has had extensive experience in secondary recovery work. From 1917 to 1919, he was engaged in unwatering mines in Mexico for the American Smelting and Refining Company by means of air-lift. In 1926 he was engaged in gas-lift operations for the Carter Oil Company in Seminole, Burbank, Tatums, and others, with trips to Colombia, Peru, Romania and Poland for Standard Oil of New Jersey. From 1933 to date, Shaw has been consultant for Westgate-Greenland Oil Company, and also for several smaller companies, with short engagements for Stanolind Oil and Gas Company, British-American Oil Producing Company, etc.

More recently he has worked with Anglo-Canadian Oil Company, Federated Petroleums, Inc., and Home Oil Company, in Alberta, Canada, in gas-lift and reserve estimates.

Hook-up at well producing 6500 bbl of fluid per day, Placedo field.



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of course, because of the active water drive. During the last five years, however, it has become evident that lifting gradually increasing volumes of fluid necessary to maintain the allowable also gradually opened the wells to greater production by producing some sand and thus permitting the formation to become more permeable and thereby improve the drainage conditions around the wells and in turn permitted large volumes of fluid to enter the well with minimum amount of draw-down in the well. This action contributed, not only to withdrawal of increasing volumes of fluid, also to a reduction in the quantity of gas required to lift a barrel of fluid to the surface. In some wells the amount of injected gas required over long periods of time has been as low as 25 to 75 cu ft per barrel of fluid lifted.

Three of the eight wells under discussion situated on the edge of the oil reservoir have been abandoned recently due to the water content having increased to between 99¼ and 99½ per cent of the volume lifted. It was possible to continue the lifting operation until this point was reached, however, continuation of disposal of the large volume at this point would have involved a large item of expense per barrel of oil lifted. In other fields where water can be disposed of in the Gulf waters the cost would have been a minor item and production would have continued considerably beyond the point that was reached in this field.

At the time of abandonment these three wells had an aggregate fluid production of about 10,000 bbl per day and one well had reached a production of 6500 bbl per day with oil content of 0.65 per cent of the fluid being produced. See table of production for data on production of water and oil.

The area under discussion is comprised of 110 acres of productive reservoir in which 8 wells had been drilled. The cumulative production of oil to the end of 1950 was 1,833,677 bbl, or 16,600 bbl per acre. The effective thickness of the sand was estimated at 9 ft, thus making a recovery of 1840 bbl of oil per acre-foot. Future reserves may increase the total recovery to about 2,250,000 bbl of oil of 20,400 bbl per acre, or approximately 2260 bbl of oil per acre-foot.

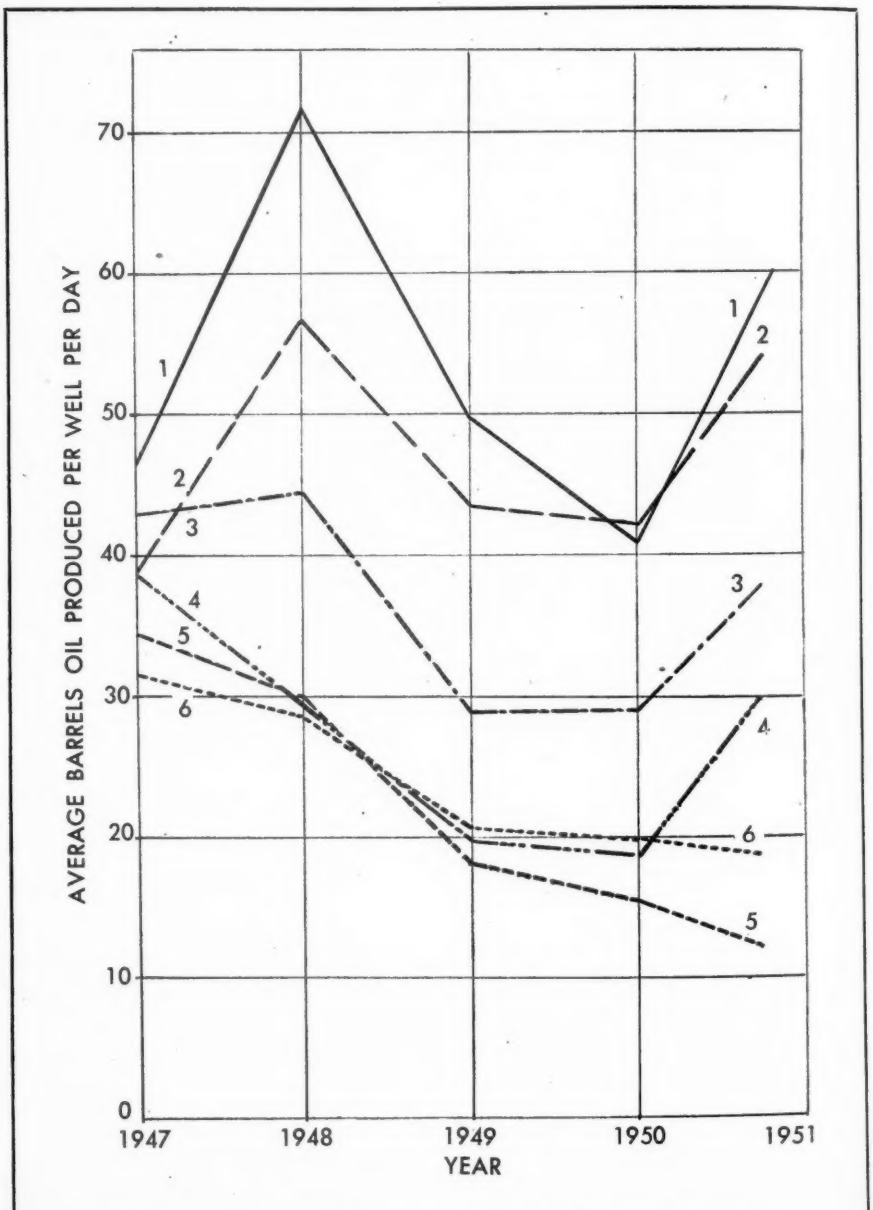
The operator of the leases above described wished to obtain an estimate of the future reserves from one of the well-known engineering firms and in 1948 was given an estimate of 91,000 bbl. At that time the percentage of water being lifted was about 95 per cent. Subsequent production has been 490,000 bbl of oil, and future reserves may increase this to a total of 850,000 bbl, or more than nine times that called for by the estimate. This, however, should not be considered as a reflection on the firm making the estimate because the facts pertaining to the character of the productive horizon could not be supplied to them in a concrete form.

The question naturally arises regarding the present comparative situation pertaining to production for the various leases in the area where the structural positions are somewhat similar to that of the leases discussed in this article. This is afforded by Fig. 1, which notes the comparative average production of oil per well per day for the six leases in the immediate vicinity. Graph 1, in the figure, is that of leases under review.

It would thus appear that with very active water drive in reservoirs of this character there are possibilities of very high recovery percentages if the water drive is utilized to maximum advantage and this can be done only when lifting the fluid at a high rate when it becomes necessary to lift a high percentage of water in order to produce the allowable.

The only practicable and economical method of lifting fluid under such conditions is gas lift. The beam pump is limited economically to about 500 bbl of fluid per day as a maximum, especially when sand enters the well. So far as volume is concerned, the electrical submersible pump can handle large volumes quite readily, but the entrance of sand from the formation into the pump increases the repair expense and the down-time by an excessive amount. In limestone formations, however, where there is little or no abrasive material to injure the pump and where the fluid level is high, the centrifugal pump is very effective.

Let us consider the inferences that may be drawn from the above statement of results. It would seem as if a natural water drive is very effective in enabling a very high degree of extraction to be obtained. This depends upon having not only an effective water drive but also in making use of the water drive to optimum advantage. It would appear that a favorable condition surrounding the immediate vicinity of the wells must be attained that will allow the fluid to enter the well with minimum resistance, and



Average annual production of 6 Edgewater leases, Placedo, Texas.

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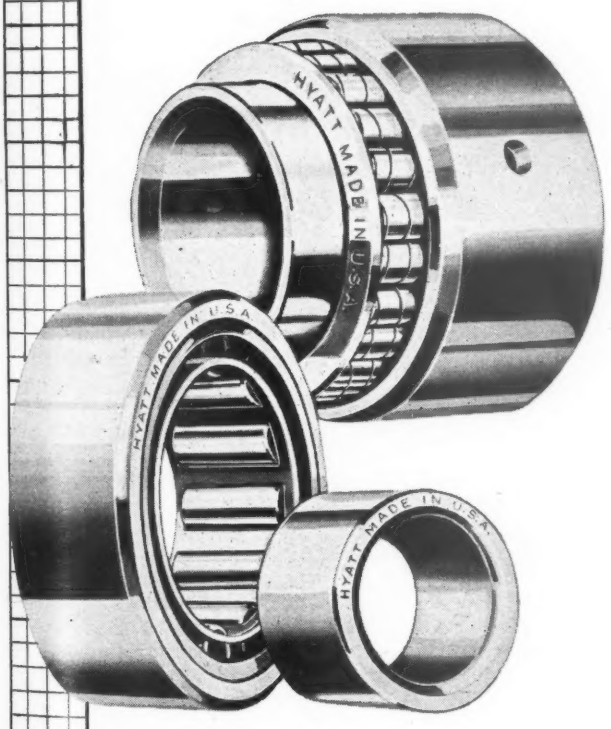

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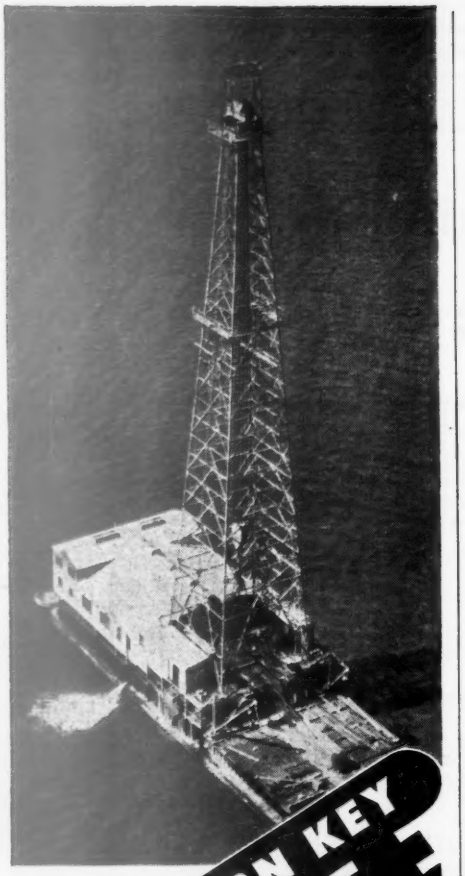

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TABLE 1. Production of fluid, oil and gas for the years 1948-1950 from leases in the Placedo field.

	1948		1949		1950	
	No. 1	No. 2	No. 1	No. 2	No. 1	No. 2
Barrels of fluid produced	3,431,700	696,255	3,761,339	744,066	3,925,500	757,700
Barrels of oil produced	187,030	22,534	126,616	18,088	101,795	17,124
Per cent water	94.6	96.8	96.6	97.6	97.4	97.8
Cu ft input gas, total	482,239	48,569	599,508	25,405	650,738	29,113
Cu ft input gas per bbl fluid	555	70	337	34	161	27
Cu ft input gas per bbl oil	2,580	2,155	4,730	1,400	6,380	1,165
Cu ft formation gas*	58,688	15,695	97,707	1,423	76,980	1,284
Cu ft formation gas per bbl oil	313	700	770	72*	756	75*

* These apparently very low formation gas-oil ratios are probably due to the large volumes of water carrying out gas entrained with the water.

the operator must be prepared to lift the fluid in whatever volume becomes practicable and possible to lift. It appears that a natural water drive, if present, is much more effective than an artificial water drive in that the flushing action of hot water is maintained over the entire front of the producing formation, and is not carried out by injecting cold water at various points along the reservoir. If an active natural water drive is not present, however, the next best thing would appear to be that of injecting water down the flank of the structure, such as is being done in the Midway field, Arkansas[3] and at other similar projects now under way. A thought that comes to the writer in connection with the Midway type of field is that it might be augmented by installing gas-lift in wells, instead of pumps, where these wells have ceased to flow naturally due to water having reached the wells, and to lift the oil from such wells at increasing volumes, at the same time returning this water to the water-injection wells down the flank of the reservoir where oil no longer is present.

The technique of lifting the fluid becomes one of much importance. A knowledge of lifting large volumes of oil and water was gradually evolving when the Seminole, Oklahoma City, and other early fields were producing large volumes of oil and water, that is, up to 10,000 bbl per day, but under the drastic limitations gradually being placed on daily rate of production, which became necessary in order to restrict production to the demand, increasing development of knowledge as to handling large volumes came close to an end. It is unfortunate that a comprehensive gas-lift research project was not instituted at that time to determine the factors that apply to the lifting of liquids in any capacity from considerable depths but this was not done, and no one at the present time seems to be sufficiently interested in taking up such a research project.

Some observations on principles concerning gas-lift flow might be interesting at this time.[5,6]

1. The production to be lifted must be accomplished by use of the proper size of pipe through which to carry on the operation.

2. The pressure at the bottom of the flow pipe has a great influence on the capacity of the flow pipe, and on the quantity of gas required to lift a barrel of fluid. There is, however, a limiting pressure beyond which it is not practicable to carry on the operation, and capacity must be obtained by employing the optimum diameter of flow pipe.

3. The size of the flow pipe to be employed in efficient gas-lift operations depends upon the flow to be obtained, rather than the adaptation of the flow to the size of the pipe already in the well.

4. The condition immediately surrounding the entrance to the well bore-hole, in various instances, can be changed by the use of gas-lift so as to permit a greater volume of liquid to enter the well; that is, the restriction at the entrance to the bore-hole can be reduced, and this permits production to be obtained in a more efficient manner.

Shooting wells at Seminole and Oklahoma City resulted in enlarging the wells bore and this usually brought about a higher production rate and usually was accompanied by a reduced formation gas oil ratio, whether the well was produced by natural flow or by gas-lift[7]. The inference may be drawn that under certain favorable reservoir conditions, the production of fluid in large volumes is of advantage in obtaining a high percentage of extraction. Various projects carried out during the last 10 years indicate that it is of advantage to maintain pressure in the reservoir, so far as possible, by injection of water below the oil in order that lifting of larger volumes of fluid from producing wells can be carried out without unduly lowering the reservoir pressure. In the instance mentioned at Placedo in this article there is a very active water drive present, therefore, there is no necessity for returning the produced water to the formation in order to maintain reservoir pressure.

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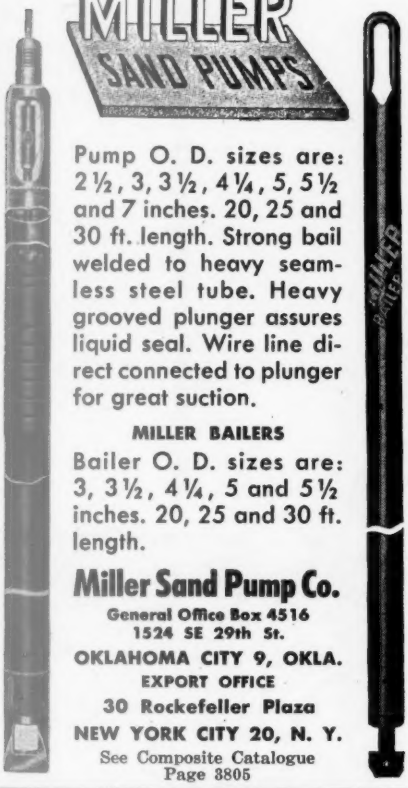

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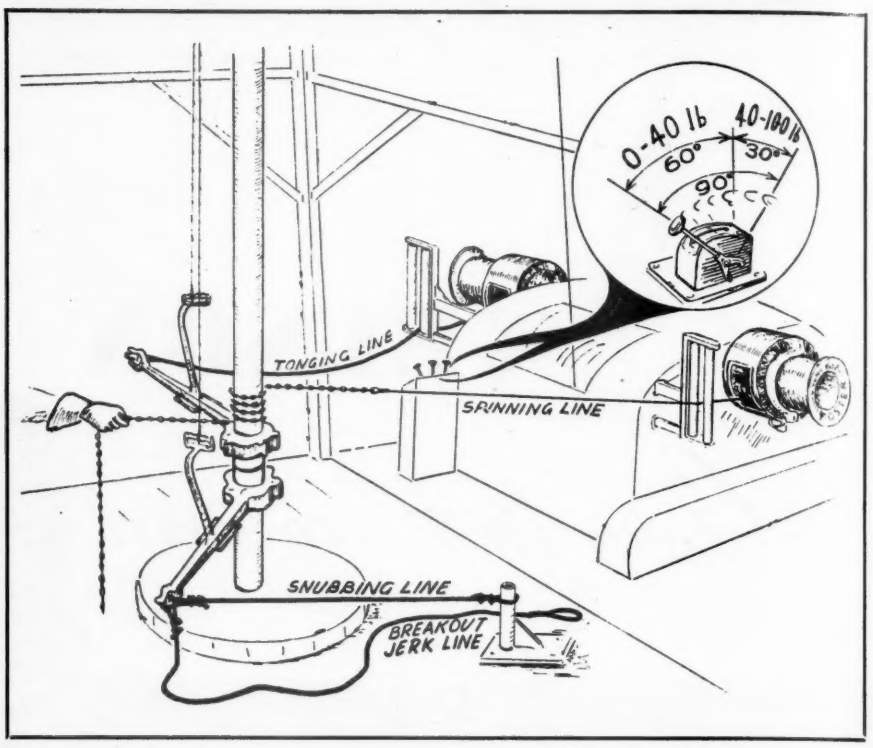

Spinning Drill Pipe

W. W. FOSTER*

The accompanying sketch illustrates the "two line" and "two cathead" method of spinning and tonging drill pipe and casing.

The "tonging line" serves two purposes. 1. The pipe is tonged or tightened when the spinning is stopped. 2. The Kelly joint is broken when a connection is to be made. This is done by placing the lead tong on the tool joint box and the backup tongs on the tool joint pin. The breaking then is done with the driller's side cathead.

The "spinning line" is looped on to the cathead when the trip "in the hole" is begun. It is not removed until the next trip "out of the hole" is begun. The "spinning line" is then removed and the "breakout jerkline" is looped on to the cathead for breaking the joints.

The "tonging line" is left attached to the "driller's side cathead" at all times.

The "spinning line" and the "breakout jerkline" are used alternatively on the "breakout cathead." The "spinning line" for spinning the joints and the "breakout jerkline" for breaking the joints.

High speed lineshafts have made it necessary to apply air to air-operated catheads at very low pressures until the slack is taken out of the spinning or jerkline and then be able to increase the pressure sufficient to make any desired pull on the line in use.

A study of the valve in the above arrangement shows that this problem has been solved.

The above "two line" and "two cathead" method has been in use for many years and, to my knowledge, no one has returned to the forked line practice from the above system.

The "two line" and "two cathead" system was not perfected as shown until about three years ago.

Advantages of the "Two Line" And "Two Cathead" System

Safety. The forked line swivel is not pulled, under tension, behind the driller.

The spinning line goes direct from the breakout cathead to the drill pipe and if the chain should break, none of the crew would be injured.

The tonging operation can be started the second the spinning operation is completed without hazard to the man removing the chain from around the pipe.

Speed. The lead tong is placed on pipe as the joint is spun in. A line is attached to driller's side cathead and the lead tong.

The joint can be tightened instantly after the pipe stops spinning. No time lost pulling the tongs back to position or waiting for the spinning line to be removed from the pipe.

If the well is too close to the cathead for the successful operation of a forked line, the two line system will solve the problem completely. * * *

*Foster Cathead Company.

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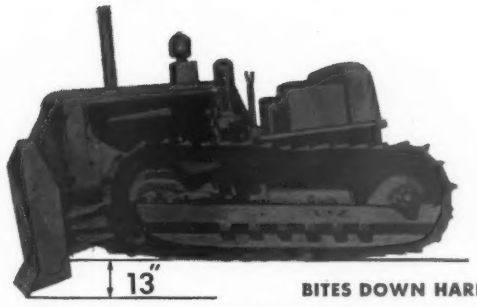

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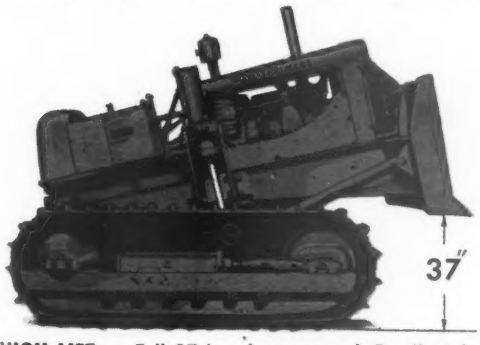

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NO PUSH BEAMS. A completely new idea in bulldozer engineering, the 9X blade is mounted directly to the HD-9 main frame. Tractor main frame and dozer are raised and lowered as a single unit.

LIGHTER WEIGHT — BETTER STABILITY. Almost 1,150 lb. lighter than standard dozer. Costs less to buy. And with lighter blade mounted 15 inches closer, tractor center of gravity is not upset. No excess wear on front truck wheels and support rollers.

BIG DIRT MOVER. Because of extra clearance, greatly increased track oscillation and better balance, this team is a phenomenal performer in mud and tough going. And with blade fully six inches higher, capacity is kept on par with conventional blade.

SIMPLIFIED SERVICING. 1,000-hour lubrication of truck wheels, idlers and support rollers. Dozer mounting does not interfere with engine accessibility. No removal of major tractor assemblies. Hinged grill swings out for easy access to dozer hydraulic pump, or to clean radiator core.

EASY TO OPERATE. Just by pulling a single lever, operator can shift from any of the six forward speeds to any of the three high speed reverses. This, plus narrow, frame-mounted blade makes the HD-9 particularly fast and maneuverable. With no spring deflection, blade responds immediately and positively to control levers.

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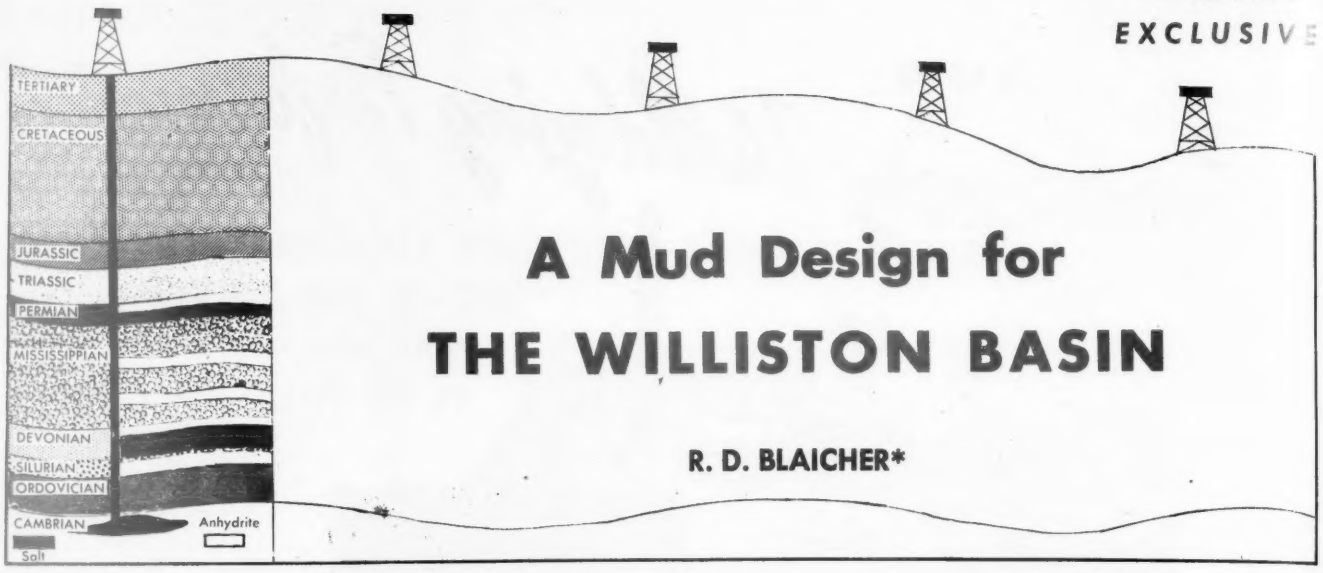


A Mud Design for THE WILLISTON BASIN

R. D. BLAICHER*

PROPER mud design is important in solving many of the drilling problems encountered in the rapidly expanding Williston Basin. Sloughing shales in the upper part of the hole and massive salt, gypsum, and thief zones in the lower portion of the hole greatly influence the selection of the proper mud characteristics. These hole conditions and the necessary mud program can be explained with a brief geological discussion of the basin.

The regional syncline known as the Williston Basin is situated largely in North Dakota with portions extending into Manitoba and Saskatchewan in Canada, into Montana to the west, and South Dakota to the south. (Fig. 1) The basin rises gradually from the deepest point southwest of Williston, in western North Dakota, towards the precambrian shield in Minnesota, and rises more rapidly westward towards the Montana plains. The large Cedar Creek or Baker-Glendive fold in southeastern Montana and the north-south trending Nesson Anticline near Williston, North Dakota, are the two major structures so far noted. It was on this latter structure that the first oil producing well was drilled early last spring and went on production in July of last year.

Generally, the basin consists of sections of sedimentary rocks totaling about 12,000 ft in thickness. The sedimentary sections include rocks of most of the geological systems with the notable exception of the Pennsylvanian and Permian systems, which are not extensively developed throughout the Basin.

From a mud design approach, the basin may be divided vertically into two segments. (Fig. 2) In the lower group of rocks, directly overlying the Precambrian granites and gneisses, limestones and dolomites predominate with minor groups of sandstone and shale. Included in this lower group are rocks extending from the Ordovican, to the Jurassic period. The lower group is noted for the occurrence of evaporites and the noticeable absence of long shale sections. Anhydrite and gypsum exist extensively throughout the section and occur in massive proportions in the Mississippian, Charles, and Triassic-Spearfish formations. A thick section of salt was reported on the discovery well in the Devonian formation and salt has also been reported in the Spearfish group.

The long section of Upper Cretaceous shales and Cenozoic deposits at the surface distinguish the other main grouping of the vertical section. This section, ranging from 1600 to 6100 ft in thick-

*Assistant division field service engineer, Baroid Sales Division, National Lead Company, Mid-Continent Division.

FIG. 1. Williston Basin—West-East cross section.

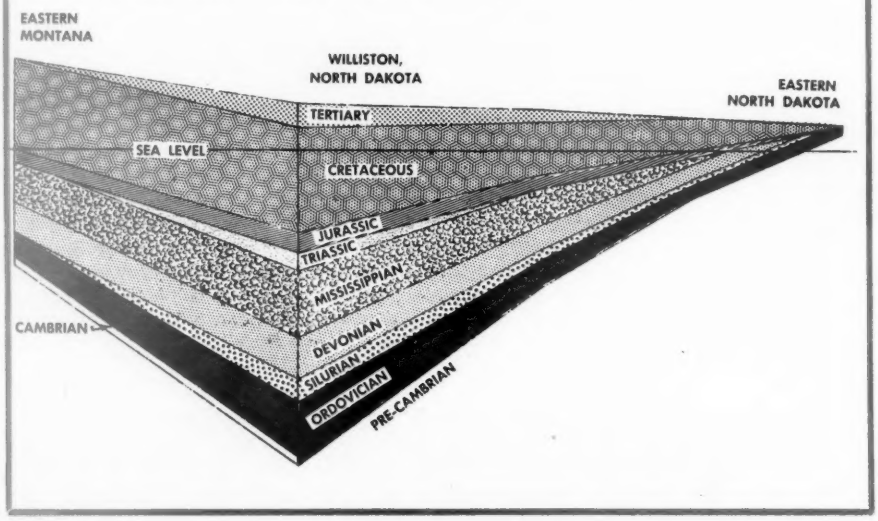
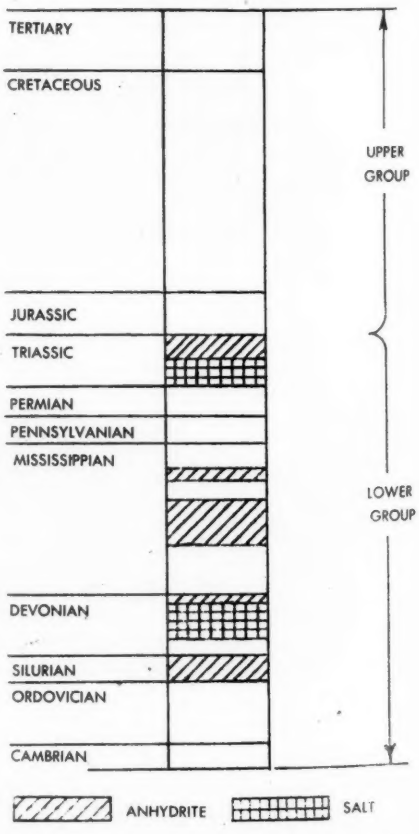


FIG. 2. Mud contaminant log. Williston Basin



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ness, is predominantly shale, some of which are quite bentonitic, intermingled with sandstone.

Mud programs in the Williston Basin must cope with a long, exposed, unsupported shale section at the top of the hole and with the contaminating effect of massive anhydrite and salt in the lower part. Although upper-hole drilling is favorable to a fresh-water-mud, its continuation is restricted by massive salt and anhydrite in the lower part of the hole. The massive salt sections are usually drilled with saturated-salt-mud to prevent dissolving of formation salt; dissolving of formation-salt would result in large hole cavities that create conditions favorable to twist-offs and bad fishing jobs. Similarly, the massive anhydrite sections are usually drilled with muds saturated with anhydrite (calcium sulfate, water free gypsum). Saturated gypsum muds have been used successfully since 1948 to drill the massive Devonian anhydrite in Canada.

Saturated-salt or gypsum-muds are fabricated by adding rock salt or gypsum, as the case may be, in sufficient quantities to saturate completely the base mud (Fig. 3). In both mud types, modified starch is used as the filter loss control agent, along with a preservative to prevent fermentation of the modified starch. In a salt-water-clay-mud, special salt water clay is used as the viscosity builder, and either special salt water clay or bentonite may be used to build viscosity in a gyp-mud. Properties of the saturated muds are little affected upon further contamination with either anhydrite or salt. General properties of two muds used in widely separated parts of the Williston Basin are:

	Salt mud	Gypsum mud
Wt, lb/gal	10.7	9.4
Viscosity, API funnel (sec.)	57	57
Initial gel, API (grams)	10	36
10 minute gel, API (grams)	25	36
Water loss, API (cc)	9.6	11.0
pH, indicator	6.0	7.0
Salt, ppm	331,300	2000
Barium carbonate, pounds per barrel of mud	.50	.50

The preparation of salt-muds usually requires up to 125 lb of salt per barrel of mud; gyp-muds require from 3 to 4 lb of calcium sulfate per barrel of mud.

Throughout the Williston Basin the current mud program consists of drilling the upper shale sections with a fresh-water-bentonite-mud treated with caustic soda and tannin compound. Barium carbonate may be added to these muds whenever make-up water is badly contaminated with gypsum. This upper-hole-fresh-water-mud treatment is continued to the Spearfish formation. Then, if salt is encountered in massive form, a saturated salt-mud is prepared, enabling the operator to control hole-washouts through the salt section. Any gypsum or anhydrite encountered can be tolerated by this salt-mud without additional mud treatment. On the other hand, where salt is not expected, or where it may exist as stringers and hole-washouts are not serious, then the gyp-base-mud would be prepared instead of the salt-mud. This latter approach has several advantages over the salt-mud due to the presence of a much lower concentration of chemical. There is a lower mud cost due to the reduction in chemical and salt requirements; less loss of circulation trouble because of the lower mud weight and higher mud resistivities, which aid electric log interpretations.

* * *

FIG. 3.

Typical composition

Salt mud	Gyp mud
Special salt water clay	Bentonite Special salt water clay
Modified starch	Modified starch
Barium carbonate	Barium carbonate
Salt	Gypsum

Typical mud properties

	Salt mud	Gyp mud
Weight, pounds per gallon	10.7	9.4
Viscosity, API Funnel (seconds)	57	57
Gels, API Stormer (grams)	10-25	36-36
Filter loss, API	9.6	11.0
pH, indicator	6.0	7.0
Salt, ppm	311,300	2000
Barium carbonate, pounds per barrel of mud	.50	.50

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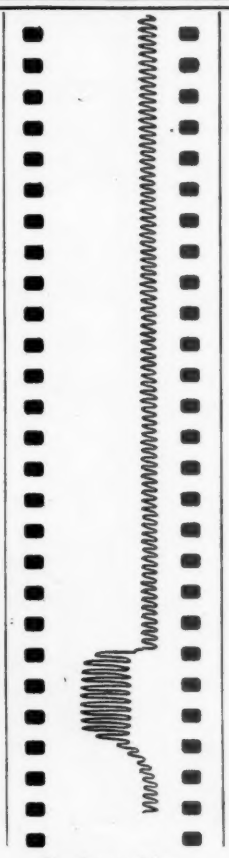
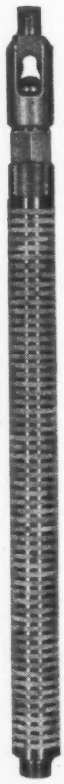


Specimen of tape indicating saturation



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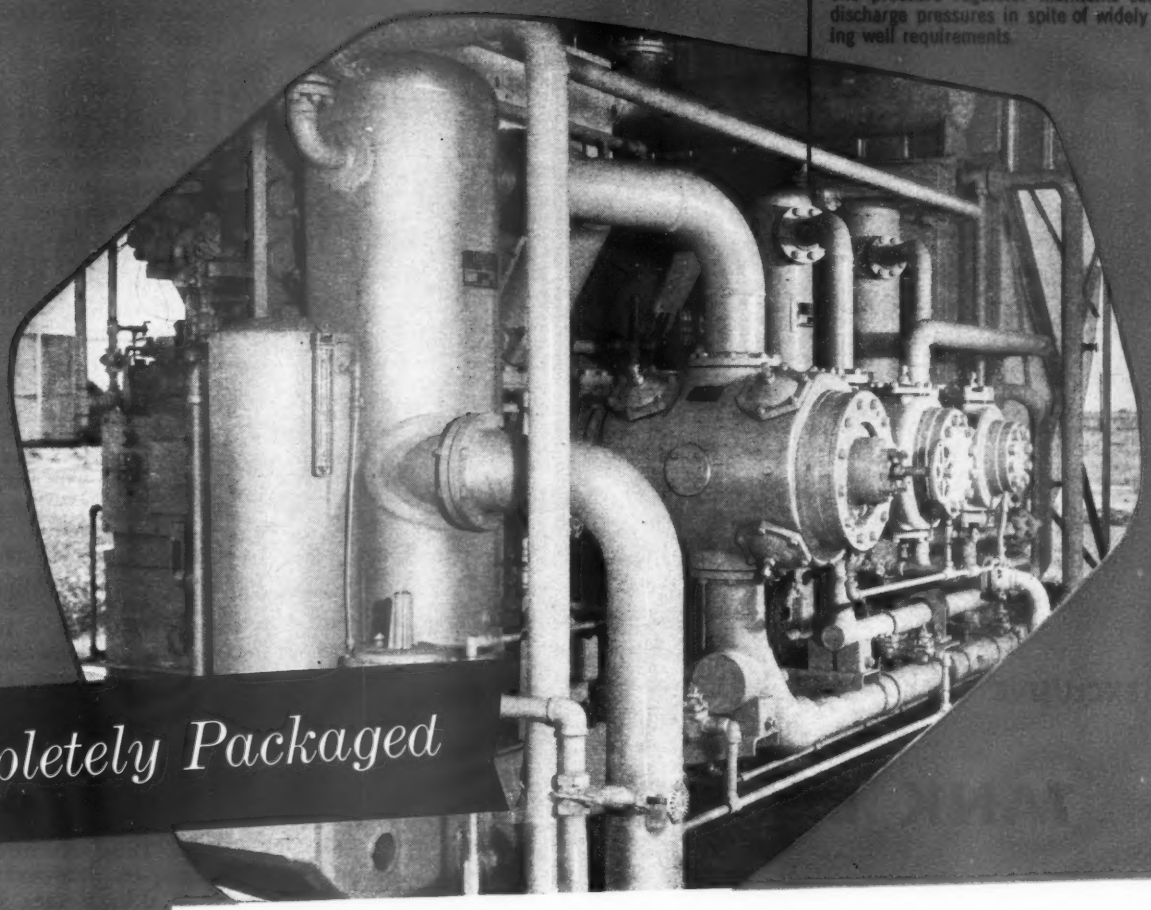

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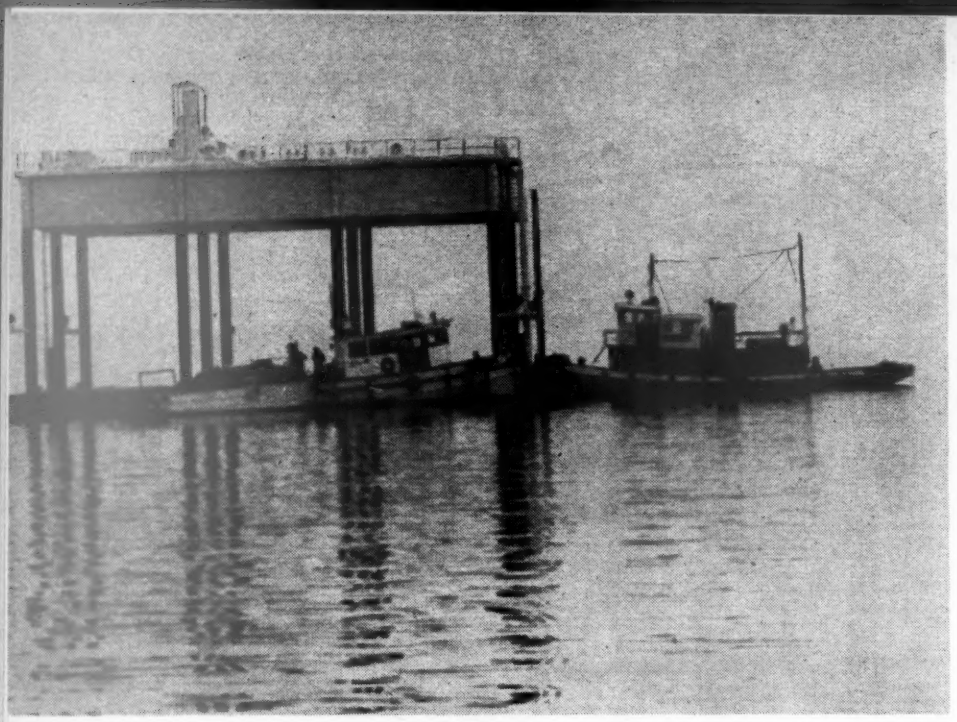

Barge floating.

EXCLUSIVE

TANK BATTERY BARGE

Gulf Oil develops 4800-bbl submersible tank battery structure for use in marshy terrain or in shallow water along coast

Barge being submerged.

CONSTRUCTION of crude oil storage and producing installations have always presented a complex problem to the oil companies operating in the marsh and shallow water regions of the Gulf Coast. The soil, if such exists, has insufficient strength to support the land type installations that are familiar to most oil men throughout the industry, and it is necessary to resort to more expensive construction methods in order to produce the type of fields under discussion.

In the marsh type field, which is usually made accessible by a system of dredged canals, oil storage barges are being employed to good advantage. Such a barge is located in a dredged slip and contains on its deck the necessary separators, pumps, lines, etc., to handle properly the oil from the wells in the nearby area. The crude oil from a barge of this type is either pumped or barged to a larger tank farm or terminal for transport to a refinery. The producing storage barge just described is practical only where the location is in protected water, and has a limited application since most of the coastal fields are in open, unprotected water.

The type of construction generally used in these open water fields is that of platforms supported by piling above the action of the waves, which are frequently violent as a result of the numerous storms and squalls prevalent along the coast. These structures must also be designed to withstand the force of the tropical hurricanes, which are likely to occur during the months of August, September, and October. A tank battery supported by piling must be considered a permanent installation since the cost of pulling the piling and relocating the battery is too great to warrant such action. Due to the fact that the producing limits of a field are not usually known during its early development, many of these tank batteries are improperly located with resultant prob-

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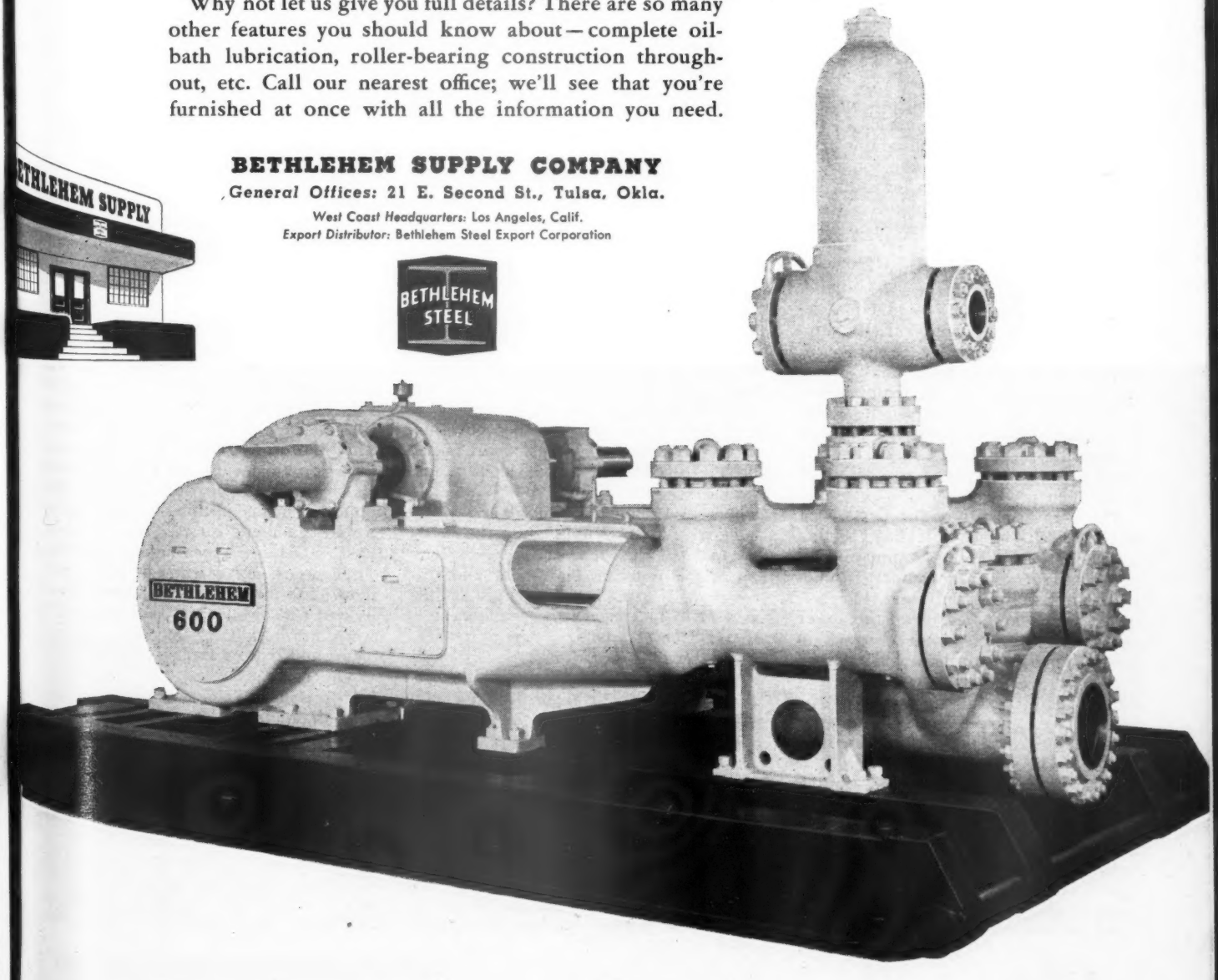

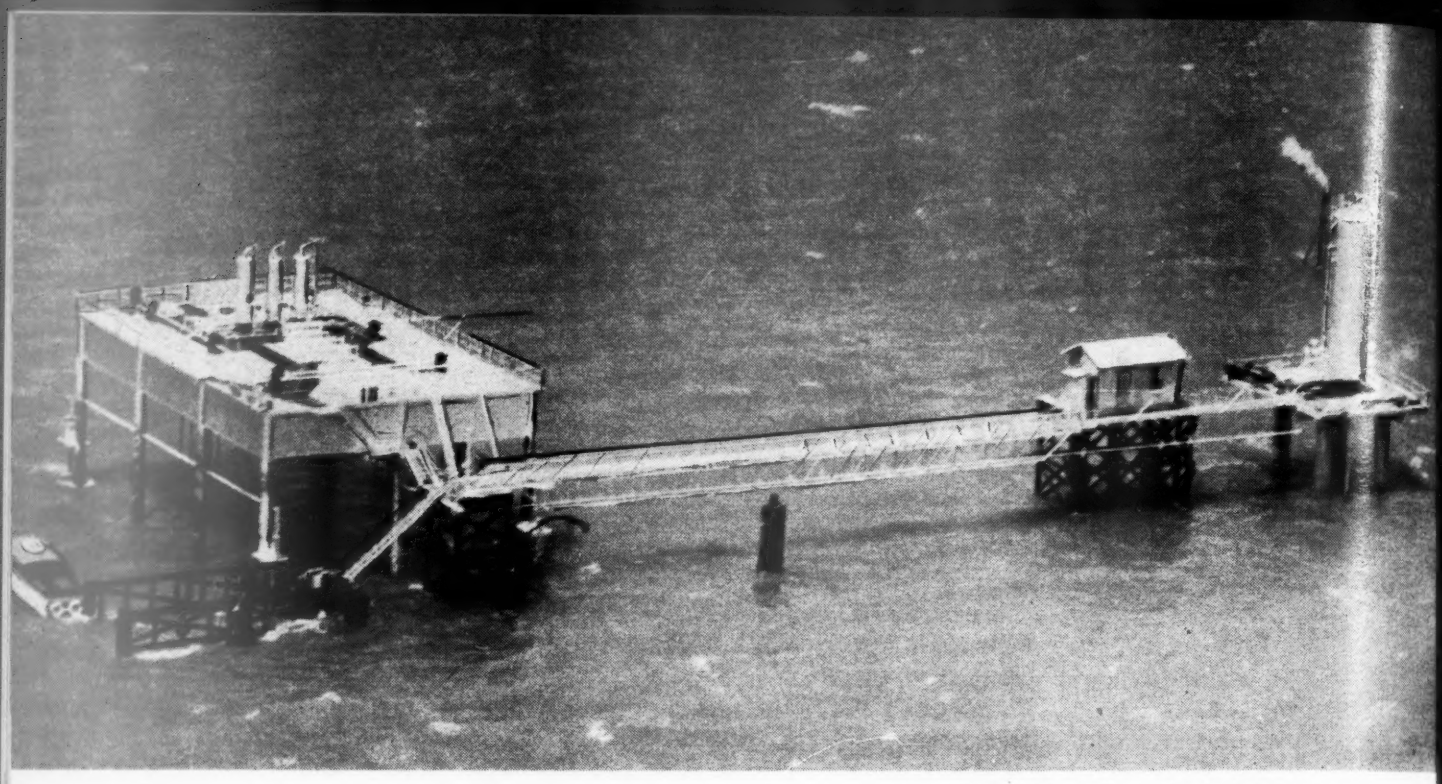

Barge in service with additional structures.

lems of extra long flow lines, unneeded storage space, and additional battery construction. Such a condition is very undesirable and indicated the need for a new and more flexible type of producing and storage structure.

The Gulf Refining Company, one of the major producing companies in the coastal water areas, recognized this need for a new type structure and sought to develop a practical design for use in its Black Bay field, Plaquemines Parish, Louisiana. This field is located in open water 6 to 8 ft deep and is a faulted structure of undefined productive limits. With the basic requirements in mind, personnel of the Gulf's production department consulted with various shipbuilding firms. After an exchange of ideas, a firm on the Gulf Coast developed a design that met the requirements desired, and this firm was commissioned in August, 1950, to construct the first submersible type tank battery barge. The barge was completed and delivered to the field in December, 1950.

The barge consists of two parts. One is the lower submersible float section and the other is the upper storage compartment section. The upper is supported by twelve 20-in. diam steel columns, which are erected on the lower part. The entire structure is towed to the desired location and submerged by flooding the lower section with water. If the location should later prove to be improper, the barge can be relocated in a few hours by deballasting the float section with compressed air, towing it to the new location and again sinking it. This mobility feature is one of the greatest advantages provided by the barge design. The entire barge is of welded steel construction and is designed to provide 4800 bbl storage in water depths up to 12 ft and to withstand the severest wave and wind action.

The submersible float section is 80 ft by 52 ft by 5 ft and is divided into four equal sized compartments, which can be control flooded to maintain stability during submerging operations. This is possible by use of a 6-in. line to each compartment provided with 6-in. gate valves, which are controlled from the top deck by means of extension rods.

Submerging Operation

The submerging procedure calls for the two forward compartments of the floating section to be flooded first. After the forward end is resting on the bottom the aft tanks are flooded and the barge is leveled out on the bottom. Refloating the barge requires the use of an air compressor. This compressor can be carried on the deck of a boat moored along side the barge and is connected to the barge on the top deck, where two 6-in. goosenecks are provided for this purpose. These goosenecks are connected to the lower section tanks through the two center 20-in. columns, which also serve as vent pipes. When compressed air is applied to the compartments with the sea chest valves open, the water is blown out and the barge will float. The procedure is the reverse of that used when submerging; that is, the aft end is raised first, then the forward end.

The upper section of the barge is 72 ft by 48 ft by 8 ft and is divided into six 800-bbl compartments, each provided with a 3 ft diam, 2½ ft high expansion dome to the top deck for thiefing and inspection. Each of the 8 tanks has a 6-in line leading to a header for loading the stored oil to transportation barges through a rubber hose. Each tank is also equipped with hairpin type steaming coils. The top deck of the barge provided space for all necessary separators, pumps, headers, lines, and connections for handling the crude oil. Included are one 125 psi working pressure separator, one 500 psi W. P. separator, one 1000 psi W. P. separator, and one 7 by 4½ by 10-in. gas pressure operated transfer pump. Oil pollution protection is provided by a gutter around the deck, which drains into sumps inside two of the supporting columns. These columns act as oil-water separators and the separated oil can be returned to storage by the transfer pump. The entire upper deck of the barge is bordered by a hand rail for safety and spuds are located on each corner to assist the barge in resisting severe storm conditions.

After the submersible barge was installed in the field it became necessary to provide treating facilities. This was accomplished by installing a 28 ft by 30 ft prestressed concrete piling platform supporting a vertical emulsion treater. This platform is accessible to the main structure by means of a steel marine walk way. Also provided by Gulf Refining Company in this field installation were a pumper's quarter house, a boat dock, and an oil-loading-out platform. Four wells are currently being produced into this barge with a daily allowable of 672 bbl net oil. Two of the four wells are producing 50 per cent salt water and require treating.

The barge has operated to the complete satisfaction of all personnel concerned, requiring a minimum of attention and maintenance. It is thought that the submersible type tank battery barge is a definite solution to the problem of shallow, unprotected water located oil field production, and that its greatest value will be realized by a long period of low maintenance costs and by its being completely salvagable should it ever be desired to move or recover the barge. ★ ★ ★

Morgan J. Davis

Morgan J. Davis Will Head AAPG for 1952

Officers will be installed at annual meeting with SEPM and SEG at Los Angeles, March 24-29

AMERICAN Association of Petroleum Geologists, Society of Economic Palentologists and Mineralogists, and Society of Exploration Geophysicists are holding their regular joint annual meeting Los Angeles, California, this month.

Program for the joint meeting was carried in the February issue.

AAPG Officers

Morgan J. Davis, vice president and director in charge of exploration, Humble Oil and Refining Company, Houston, Texas, will become the 36th president of the American Association of Petroleum Geologists on March 27. Other AAPG officers elected to serve during 1952-53 include John G. Bartram, consulting geologist, Stanolind Oil and Gas Company, Tulsa, Oklahoma, as vice president; Robert H. Dott, director, Oklahoma Geological Survey, Norman, re-elected secretary-treasurer; and Dr. Kenneth K. Landes, department of geology, University of Michigan, Ann Arbor, re-elected as editor of the AAPG monthly Bulletin of Petroleum Geology. The new slate of officers, with Frank A. Morgan, Richfield Oil Corporation, Los Angeles, California, serving on the executive committee as past president, will assume the responsibility of directing the activities of the 8700-member association at the conclusion of the 37th annual meeting. Present executive committee members retiring at that time are C. L. Moody, consulting geologist, Ohio Oil Company, Shreveport, Louisiana, as past-president (1950-51), and Lewis G. Weeks, chief research geologist, Standard Oil Company (New Jersey), New York City, as vice president.

President-elect Davis brings to his AAPG position a wealth of experience acquired during his rise from field geologist to director in charge of exploration of the Humble Oil and Refining Company. Davis studied geology at Texas Christian University, later transferring to the University of Texas. He joined Holway Engineering Company, Tulsa, in 1922, before completing his undergraduate work. This experience proved to be a 2-year interlude in his academic training, and he returned to the Austin campus in 1924. Completing his geological studies the following year, Davis was granted his A.B. degree in geology by the University of Texas in 1925.

Upon graduation, Davis joined the geological department of Humble Oil and was assigned to reconnaissance and detailed structural mapping near Cisco, Texas. Transferred to Eastern New Mexico, Davis engaged in aerial and structural mapping in this region until 1928.

Bartram, vice president-elect, is a charter member (1917) of AAPG. Bartram had his first training in geology at Williams College. Majoring in chemistry, with a geology minor, he received his B.A. degree in 1914. The following year he took graduate studies in geology at Williams, where he also served on the staff as assistant geologist. During the summer field season of 1915, Bartram worked as an assistant geologist on the Maryland Geological Survey. That fall he entered Johns Hopkins University, Baltimore, and continued his graduate work in geology until accepting a position as geologist with the Roxana Petroleum Corporation in 1916. From 1919 to 1923, he served Roxana as district geologist in Southern Oklahoma and Northern Texas. Becoming Rocky Mountain district geologist for the Midwest Refining Company in 1923, Bartram served this company until joining Stanolind Oil and Gas Company in 1933, as Rocky Mountain division geologist. In 1939 he was moved to Tulsa as Mid-Continent division geologist. He was appointed as manager of the Stanolind exploration department in 1946. Bartram's present position with Stanolind is that of consulting geologist.

Re-elected secretary-treasurer, Dott is serving his 16th year as director of the Oklahoma Geological Survey. Dott attended Morningside College in Sioux City during 1913-14. Transferring to the University of Michigan, where he majored in forestry, Dott received the

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Curtis H. Johnson
General Petroleum Corporation
SEG General Chairman

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Fullerton Oil Company
Finance Chairman

Frank S. Parker
Signal Oil & Gas Company
Chairman of Field Trips

From HEAD to SHOE

Back pressure valve connected to top plug.

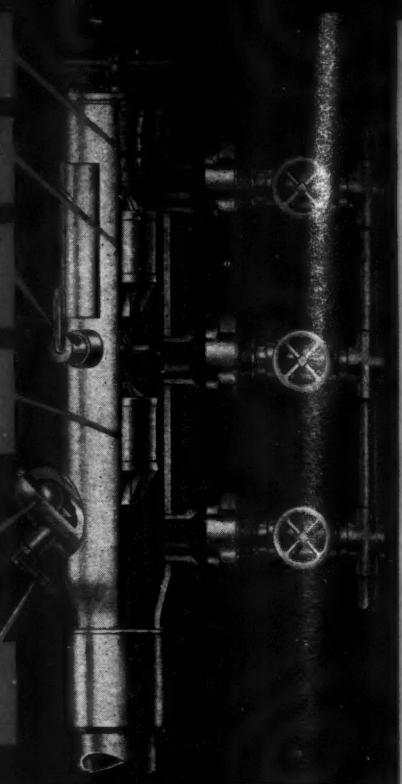
Top plug rides cement column down the casing.

Plug bar releases bottom plug without shutting down or opening head.

Bottom plug leads cement column and wipes casing clean of mud.

Trip ball that ejects float assembly in shoe to provide full casing-bore discharge.

Ball dropper releases trip ball without opening head.



RECTOR FULBORE CEMENTING METHOD

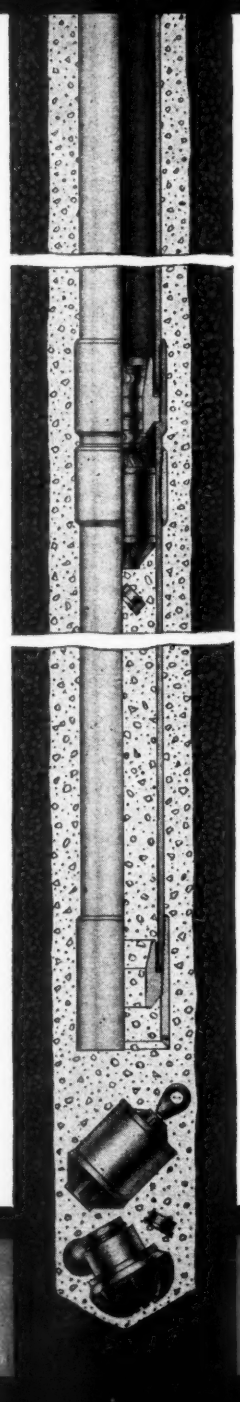
prevents contamination of cement

Every operator knows that voids caused by air pockets in the cementing string or soft spots due to contamination are the perfect set-up for future trouble. Prevention of these weaknesses is the basis of "Fulbore" cementing superiority . . . the assurance of a master cementing job, everytime.

The "Fulbore" multiple inlet head provides a closed circuit from beginning to end of cementing operations. The two plugs, made up in the head before it is connected to the casing string, are released mechanically without downtime. the plugs completely and effectively segregate the cement from the time it enters the head until discharged at the shoe. There is no possibility of contamination or the formation of air pockets.

Extreme simplicity is another advantage of "Fulbore" cementing. There are no discs to break . . . no small orifices through which the cement must be pumped. Traveling ahead of the cement, the bottom plug is pumped out of the casing through the float shoe from which the float assembly has been ejected after cementing string has been floated into position. This provides full casing discharge capacity . . . reduces the load on the pumps . . . permits greater volume to be circulated with same pump discharge pressure . . . results in higher velocity in space between casing and bottom of hole.

Every phase of "Fulbore" cementing is planned to make every job a master cementing job. Ask your Rector Representative or authorized supply store for full information about "Fulbore" Cementing and equipment.



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RECTORHEAD RECTOR FULBORE CEMENTING METHOD RECTORSEAL

ASSOCIATION OF WELL HEAD EQUIPMENT MANUFACTURERS CERTIFIED

B.S. degree in forestry in 1917. During 1916-17 young Dott also served as assistant mineralogist at the University of Michigan. After graduating from Michigan, Dott accepted a geological position with the Empire Gas and Fuel Company and did surface geological work in Oklahoma, Kansas, and Texas. He was awarded his A.M. degree in geology in 1920.

Attracted by opportunities offered geologists in foreign service, Robert Dott worked in Bolivia and Argentina for Standard (Jersey) from 1920 to 1922. Returning to the states, he was employed as a field geologist by the Carter Oil Company during the next 4 years. He left Carter in 1926 to do subsurface work for the Mid-Continent Petroleum Corporation. In 1929, Dott accepted a position of chief geologist for Sunray Oil, and held this position until he opened his own office as an independent consulting geologist in 1931. In 1935, when he was appointed director of the Oklahoma Geological Survey he was vice president and treasurer of the Aero Exploration Company of Tulsa.

Kenneth Knight Landes, re-elected editor of the AAPG monthly Bulletin of Petroleum Geology, is a professor in the department of geology at the University of Michigan, at Ann Arbor. A westerner by birth, Landes majored in geology at the University of Washington, receiving a B.S. degree in geology in 1921; from Harvard University his A.M. degree in 1923, and his Ph.D. degree in 1925. Dr. Landes accepted an assistant professorship in geology at the University of Kansas in 1926, and by 1939 he had become chairman of the geology department. He held this position until he went to the University of Michigan at Ann Arbor, in 1941.

Field Trips

Supplementing the technical program, March 24 through 29, will be a number of field trips, four primarily for the petroleum geologists and one each for the geophysicists and the paleontologists.

The first trip is for the paleontologists, and will begin at 1 pm March 24. The bus will cross the Los Angeles Basin central uplift at Rosecrans field, then through Torrance field to Paols Verdes hills, and return to L. A. through Inglewood field.

The AAPG group will leave at 1:15 p.m. of the same day and will go to Wilmington field where geology of the field and description of slant drilling and production techniques will be presented.

The SEG trip will be made March 27 and will include a visit to the California Institute of Technology and the new laboratories of United Geophysical Corporation.

On March 28, the AAPG section will hold a one-day field trip that will include the recently discovered Placerita, Honor Ranch, and Castaic fields into Cuyama Valley, and through many new fields. A second unit of the AAPG group will make approximately the same trip as the unit mentioned above, but will include the Buena Vista Hills, Coles Levee, and Ten Section oil fields to Bakersfield. It will be a 2-day trip.

A scenic train trip will be made from Los Angeles to San Francisco and will stay over night in the latter city. Wives of members have been invited to take this trip. At 11:30 in the evening of the same day, another train trip will be made to Oakland from Los Angeles, and will connect with another group in San Francisco.

Entertainment Program

A cocktain party will be given on Sunday March 23 from 5 to 6:30 pm at the Biltmore Bowl for the ladies and gentlemen registered for the convention.

Tickets for "Queen for a Day" telecast at Mutual's Hollywood studio on Monday, March 24 from 3 to 3:30 pm will be given to the ladies and on the following day, Tuesday, March 25, a listening party will be held of the previous day's broadcast.

Tickets will be sold for a theater party at the Theater Mart — "The Drunkard" on Tuesday, March 25. The entire theater has been reserved for the AAPG group.

A luncheon and fashion show will be held on Wednesday, March 26, in the Crystal Room of the Beverly Hills Hotel for the ladies and later a bus tour will be taken through Beverly Hills, Westwood, and Hollywood.

Dinner dance and entertainment will be held on Thursday, March 27 in the Biltmore Bowl, which has been reserved for the AAPG. ★ ★ ★

AAPG Award to Illinois Geologist

Raymond Siever, associate geologist in the Coal Division of the Illinois State Geological Survey, Urbana, is the winner of the 1952 President's Award of the American Association of Petroleum Geologists, as announced by Frank A. Morgan, Richfield Oil Corporation, president of the Association. The award is made annually to the author, under 35 years of age, of the "most significant original contribution to petroleum geology" published in the monthly Bulletin of the Association during the previous year. Selected by a national medal award committee headed by former AAPG president, Carroll E. Dobbin, U. S. Geological Survey, the winning paper is entitled "The Mississippian - Pennsylvanian Unconformity in Illinois." Presentation of the award, which includes $100 in cash, will be made at the Biltmore Hotel, Los Angeles, March 25 at the annual meeting.

A Chicagoan by birth, Raymond Siever majored in geology at the University of Chicago, and received the B.S. degree in 1943. The following year, Siever worked as a research assistant with the Illinois State Geological Survey until entering the U. S. Army Air Force in May, 1944, in which he served in a photogrammetry unit until his release in January, 1946. Returning to the University of Chicago campus, Raymond Siever continued his geological studies, and received the MS degree in 1947. Rejoining the staff of the Illinois State Geological Survey in June, 1947, as assistant geologist, Siever has since been engaged in studies of Illinois structure and stratigraphy, and in studies of the petrology of sandstones and limestones. His prize-winning paper is part of his dissertation submitted to the University of Chicago in partial fulfillment of the requirements for the PhD degree in geology, which the university conferred on him in 1950.

Exploration Executives on Television Forum

A group of oil exploration executives will appear on the Channel 5 program, "Teleforum," of which Dr. Rufus B. von KleinSmid, Chancellor of the University of Southern California, is moderator on March 17, at 10 pm over KTLA.

Those named to participate in an exposition of oil finding fundamentals are Frank A. Morgan, vice president of Richfield Oil Corporation, in charge of exploration, and national president of the AAPG; Leo Newfarmer, manager of exploration of Shell Oil Company, and technical program chairman for the joint annual meeting; Henry Salvatori, president of Western Geophysical Company, pioneer in the development and application of the reflection seismograph; Graham B. Moody, chief reserves engineer, Standard Oil Company; and Wilbur Rankin, well known west coast consulting geologist and paleontologist. The program is a prleude to the joint annual meeting of the American Association of Petroleum Geologists, the Society of Economic Paleontologists and Mineralogists, and the Society of Exploration Geophysicists, which opens March 24.

Discussion will involve the methods by which the various scientific groups contribute to the exploration program; current petroleum reserves and future requirement, and the responsibilities of the exploration specialists.

NEWS

IPAA Sets April Meeting

Ohio oil men will be hosts to independent oil producers from throughout the nation when the Independent Petroleum Association of America holds its mid-year meeting in Columbus, Ohio, April 28-29.

Kenneth P. Milliken, general manager of Dunn-Mar Oil and Gas Company, Lancaster, and IPAA vice president for Ohio, is chairman of general arrangements for the meeting, which will be the first held in Ohio and the second east of the Mississippi by the national group.

He announced appointment of four sub-committees that will plan various facilities for the meeting. Chairmen of the smaller committees, all of Columbus, are:

W. E. Ferguson, Ohio Fuel Gas Company, entertainment; Jack Cashell, Preston Oil, reception; D. T. Ring, Waverly Oil Works, finance, and Roy B. Weed, consulting geologist, transportation.

Although the meeting is in process of development, Milliken said the association was assured one of the principal speakers will be Bruce K. Brown, Washington, D. C., deputy administrator of the Petroleum Administration for Defense.

Milliken said oil producers from 30 states will attend the meeting. The IPAA, headquartered in Tulsa, Oklahoma, has some 12,000 members representing every oil and gas producing area in the nation. Its president is Charlton H. Lyons, Shreveport, Louisiana, independent producer.

API Production Division Meeting in Wichita

The 1952 spring meeting of the Mid-Continent district American Petroleum Institute, Division of Production is being held March 19, 20, 21, at the Broadview Hotel, Wichita, Kansas. Wednesday, March 19, will be devoted to drilling and production practice committee and training committee meetings. March 20, 21, Thursday and Friday, will be devoted to general and technical sessions.

Preliminary program follows:

Wednesday, March 19

9 a.m. until 10:30 a.m. Committee meetings, Bore Hole Drift, G. C. MacDonald, chairman; Artificial Lifting of Deep Wells, J. Zaba, chairman.

10:30 a.m. until 12 Noon. Testing of Cements, Francis Anderson, chairman; Drilling Fluids, T. W. Keating, chairman; Secondary Recovery, John A. Murphy, chairman, and Core Analysis and Well Logging, G. T. N. Roberts, chairman.

12:15 p.m. Luncheon meeting of district coordinating committee and study committee chairmen.

2 p.m. Committee on Drilling Practice, G. C. MacDonald, chairman; Well Spacing, F. H. Callaway, chairman, and Committee on Supervisory Development.

2:30 p.m. Conference of district and chapter officers.

3:30 p.m. Committee on Production Practice, J. A. Bermingham, Jr., chairman.

6 p.m. Cocktail party and buffet.

Thursday, March 20

8 p.m. Breakfast for authors, presiding officers, and discussers on afternoon session.

10 a.m. General session. H. E. Miller, Globe Oil and Gas, G. C. MacDonald, Gulf Oil, presiding. Address of welcome by mayor of Wichita and response by Harold Berg, API Mid-Continent district chairman. Address by J. C. Donnell, II, president, Ohio Oil Company, and vice president of API for Production. Title to be announced later.

2 p.m. Technical session: Several papers will be presented.

Evening. Open house, all registrants guests of the Cardwell Manufacturing Company.

Friday, March 21

8 a.m. Breakfast meeting.

9 a.m. Technical session and reports of chapters.

2 p.m. Technical session: Selected papers will be presented at this session.

6:30 p.m. Annual banquet.

Daoust Sees Rise in Michigan Oil Output

William Daoust, conservation department petroleum engineer for the state of Michigan, has predicted that Michigan can alter her 9-year downward trend in oil producing, and boost crude output as much as 50 per cent. He explained that improved oil producing techniques and state proration guidance have increased oil recovery from a very low percentage to the current average of about 40 per cent, and unit operation could raise it to 50 per cent recovery.

A conservation law requiring unit operation failed to pass a Michigan legislature last year, but most geologists think all states will pass a similar law in time. Daoust said present Michigan production ratio is one barrel for every 6 bbl consumed in the state, whereas, through unit operation, one out of every three barrels used in the state might be produced in Michigan.

API Production Men. John Roberts, State Corporation Commission, Wichita, Kansas; H. E. Miller, Globe Oil and Refining, Wichita, chairman, General Arrangements Committee; W. H. Strang, API Production, Dallas, Texas; Jack L. Worley, Independent Oil and Gas Service, Wichita, chairman, Publicity Committee; Lloyd Clothier, Franco-Central Oil, Wichita, vice chairman, Housing Committee; F. W. Heiser, Derby Oil, Wichita, chairman of the Housing Committee; Harold Berg, Tide Water Associated Oil, chairman, API Mid-Continent district; Leo Ross, Lario Oil and Gas, Wichita, vice chairman of the General Arrangements Committee; V. J. Mercier, independent, Wichita, chairman of the Registration Committee, and Jake Easton, National Tube, Wichita, chairman of the Entertainment Committee. Not shown is G. C. MacDonald, Gulf Oil, Tulsa, Oklahoma, program chairman.

The Texas Company Producing Committee meeting, was held in New York, February 4 to 7, 1952. Those who attended were: Seated, A. W. Baucum, W. C. Kneale, J. N. Troxell, E. R. Filley, R. F. Baker, A. R. Wilson, R. L.. Keyes, J. H. Puls, C. B. Williams. Standing, A. C. Hunter, G. M. Clement, J. D. Elson, Jr., M. L. Terry, J. H. Rambin, Jr., E. P. Hayes, T. T. Freeman, W. V. Vietti, R. L. Lay, J. C. Brooks, R. E. King, H. H. Arnold, Jr., W. J. Hanley, T. W. G. Thomson, and G. Herzog.

Iraq Brochure Out

Iraq Petroleum Company, Ltd., has published a picture-bulletin issued to inaugurate production from its Basrah Petroleum Company concession. Iraq government granted Basrah a concession over southern Iraq in 1938 for a 75-year period. Geological exploration commenced immediately, and as a result of these surveys, a number of potentially oil bearing structures were found. Drilling at Zubair began in 1948 and was completed in 1949, having proved the presence of oil in commercial quantities in sandstones of Cretaceous age at depths of between 10,000 ft and 11,000 ft. A second well was drilled 10 miles south of the discovery well, and was also successful. Oil production from the Zubair field is expected to total 15,400,000 bbl by the end of 1952.

Humble to Build New Production Research Plant

A new research center for Humble Oil and Refining Company's exploration and production departments will be built soon in Houston, Texas.

The new buildings will be called the Houston Research Center of Humble Oil and Refining. They will house the company's geophysics and geologic research sections, the production research division, the petroleum engineering laboratories, and the shops where research equipment is made.

Mexico Describes 5 Fields Discovered Last Year

Antonio J. Bermudez, director general of Petroleos Mexicanos (Pemex) has made public geological descriptions of 5 new oil fields and one new gas field discovered in Mexico during 1951. This brings to 24 the number of new fields discovered since 1946, approximately ⅓ of all commercially productive fields discovered in Mexico in the entire 50 years of Mexican oil development.

Last year's discoveries included: Jose Colomo oil field in Tabasco, regarded as the most important in many years, has reserves already known to be more than a quarter of a billion barrels. Rabon Grande field has estimated reserves at more than 50,000,000 bbl. Trevino field. is not producing gas as yet, although the discovery well has been completed as a dual producer. Concepcion field was opened in December, but drilling is being continued to deeper sands than the Yucatecal sand, where oil was found. The Tamiahua field, was completed in November with initial production at 220 bbl daily. The Lomitas gas field has initial production of 1,800,000 cu ft.

California Offices Moved

Rocky Mountain Drilling Company has moved its offices to 121 North Robertson Boulevard, Beverly Hills, California.

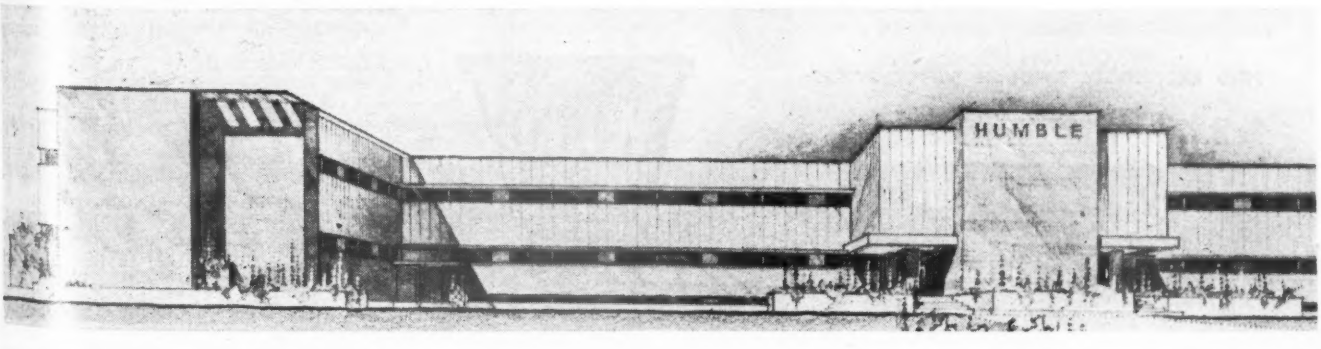
August Production Up

Last August, world crude petroleum production averaged 11,713,000 bbl daily, an increase of 52,000 bbl over the July rate, according to the U. S. Bureau of Mines report. The largest increase in daily average production was in the United States where production rose 91,000 bbl. Although daily production in Kuwait increased 41,000 bbl and Saudi Arabia's increased 18,000 bbl, total Middle East output declined 47,000 bbl daily from July due to the loss of Iranian production. Daily average production in Canada was a record 170,000 bbl, and was more than double the production in August 1950. Venezuela output decreased 8000 bbl daily from July.

Western Europe's imports of crude petroleum increased 131,000 bbl daily to 1,202,000. The larger importing countries in barrels daily were: United Kingdom, a record 415,000 (July 324,000); France, a record 410,000 (368,000); Italy and Trieste, 152,000 (144,000); Netherlands 108,000 (119,000), and Western Germany, 59,000 (66,000).

Crude petroleum exports from Venezuela decreased 50,000 bbl daily to 1,380,000, while Middle East crude petroleum exports (excluding shipments to Bahrein Island) rose 26,000 bbl daily over July to average 1,369,000. Kuwait again was the largest crude exporting country in the Middle East, shipping 659,000 bbl daily, 94 per cent higher than in the same month of 1950.

Architect's drawing shows one wing and part of main structure of new Humble research center.



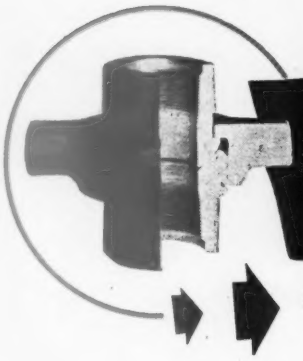


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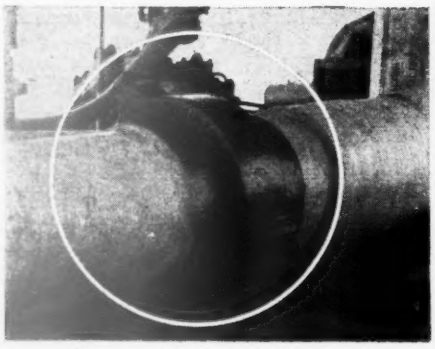
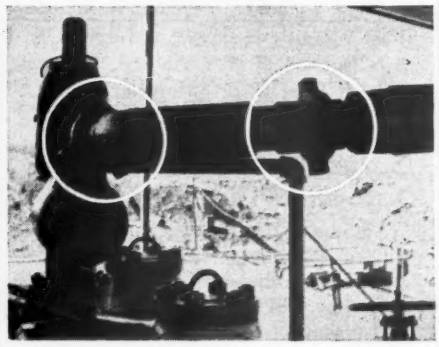
FIG. 400

4000 p.s.i. Test
Sizes: 2", 2½", 3", 4", 5½" O.D.,
6", 7" O.D., 8", 10"



The Weco Fig. 400 is ideal for pump suction connections.



Weco Fig. 400 unions save time in connecting up pump discharge lines.

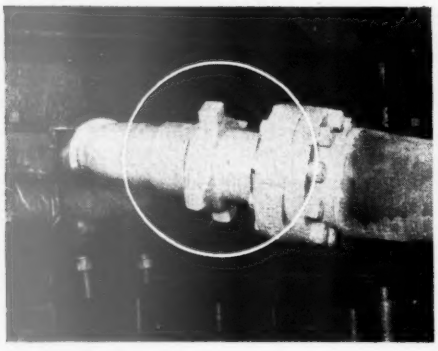
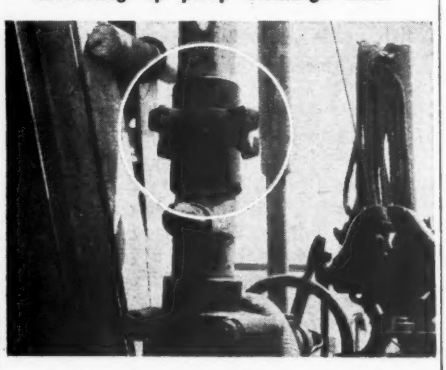


Fig. 400 Union on mud line.



4" Weco Fig. 400 Union on stand pipe.

● Unions in service on drilling rig lines get a lot of rough treatment. These mud, steam, water, oil, gas and other lines are made up and broken out frequently . . . carry fluids at high pressure with lots of vibration. The WECO Fig. 400 Union withstands more abuse in these tough services than any other union. Thicker sub end walls resist distortion . . . provide greater strength with less weight. The famous Weco ball and cone seat assures a perfect seal, every time.

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Geology Building Underway For New Mexico University

Construction of the new $900,000 geology building at the University of New Mexico, Albuquerque, was begun in January. The L-shaped building, three stories high with full basement, is modified pueblo-type architecture in keeping with other buildings on the campus. Total floor space is 60,000 sq ft, about half of which will be occupied by related Federal agencies.

The UNM geology department will occupy the first floor and basement. Included are a geology museum, classrooms, and a lecture hall seating 224; seminar, map-storage, and specimen-storage rooms; seismograph room; photographic laboratory; sawing, grinding, and polishing rooms; and offices and research laboratories for staff and graduate students.

The second floor is designed for four branches of the U. S. Geological Survey—fuels, ground water, quality of water, and surface water. The third floor is designed for the regional office of the Cartographic Division of the U. S. Soil Conservation Service.

Appointed Vice President

Paul L. Kartzke has been appointed a vice president of Shell Oil Company of Canada, Ltd., and becomes area manager in charge of Shell's exploration and production in western Canada, with headquarters in Calgary.

Kartzke succeeds E. G. Robinson, who has announced his intention to retire at the end of May. Robinson, a veteran of 27 years with Shell, spearheaded the company's revitalized exploration program in the western part of Canada, and is one of the most widely known oil men in Canada.

The new executive comes to this region from his position as Rocky Mountain division manager in Casper, Wyoming, where he guided Shell operations that led to important discoveries in the Montana part of the Williston Basin.

Kartzke began his career with Shell in 1935, and in 1948 was appointed Rocky Mountain division manager in the company's Pacific Coast area. He holds a graduate engineering degree from California Institute of Technology.

IOS Sets 1952 Meet

The International Organization for Standardization (IOS) will hold its triennial meeting at Columbia University in New York City June 9-21, 1952. The announcement was made by the American Standards Association, U. S. member of the IOS, which will act as host. Delegates from the 32 member nations will take part in the IOS general assembly, which last met in Paris in 1949. Meetings of the IOS Council and a number of its technical committees will also be held during the two-week session.

M. Albert Coquot, president of the French Standards Association, is president of IOS. The secretary general is Henry St. Leger, with headquarters in Geneva, Switzerland.

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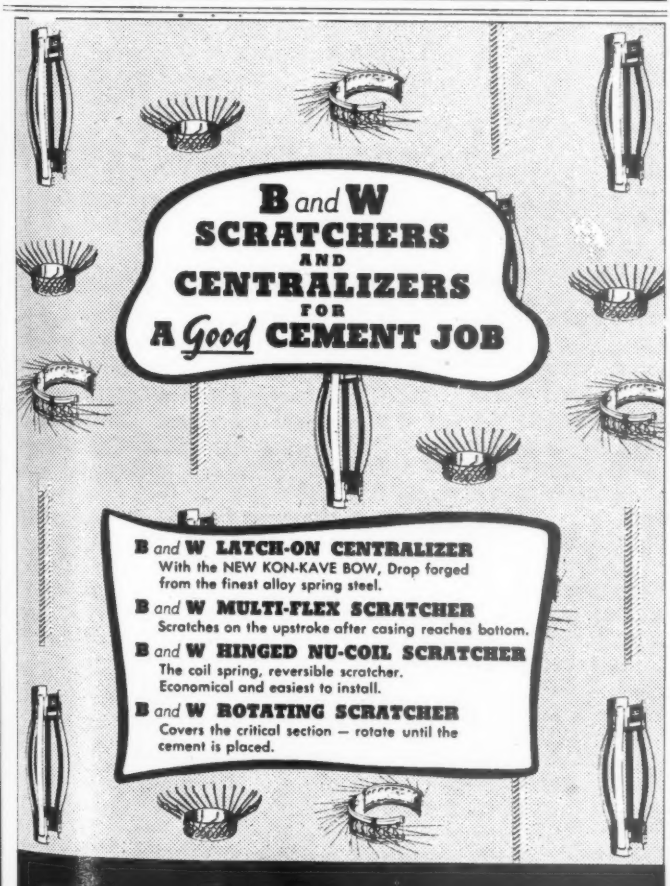
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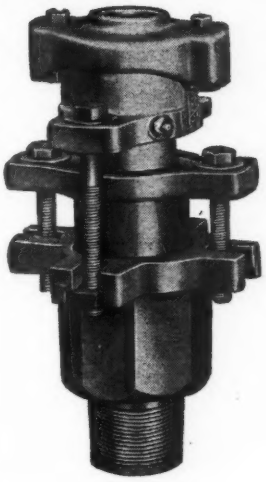

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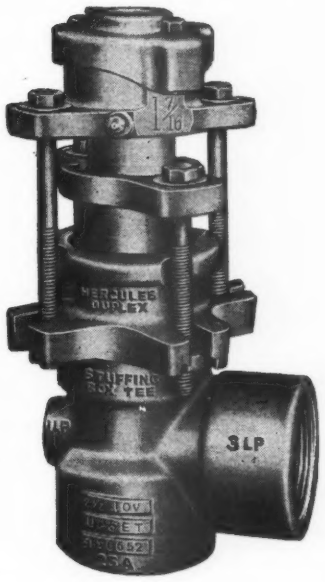

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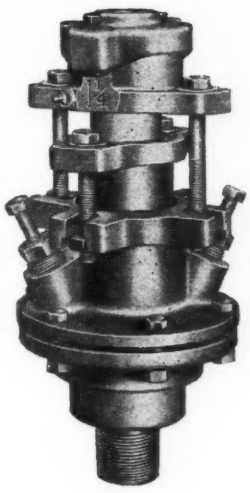

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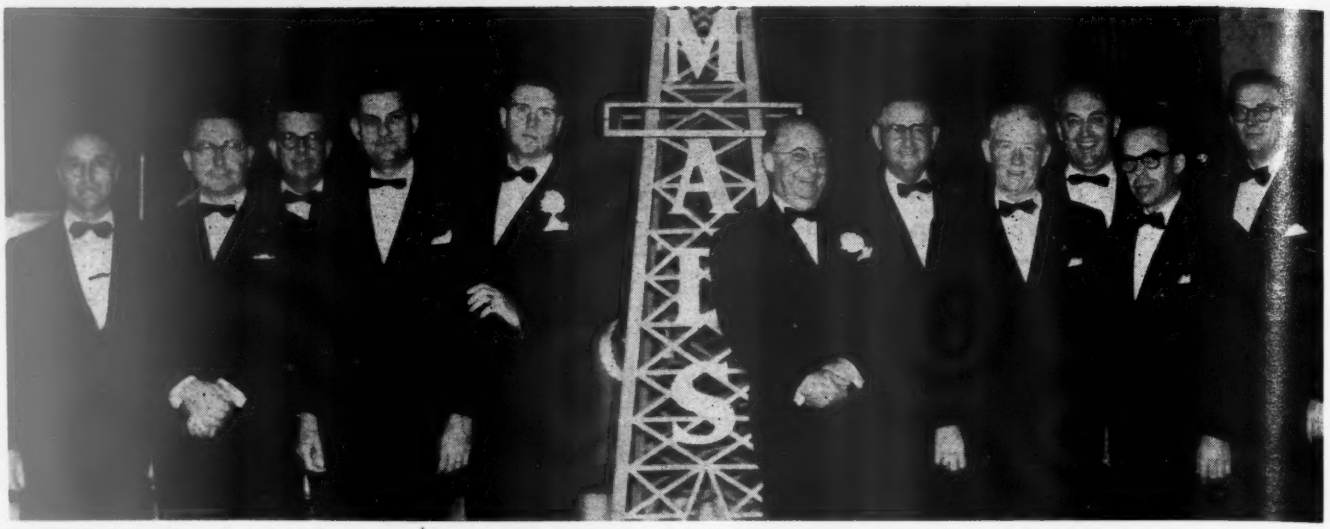
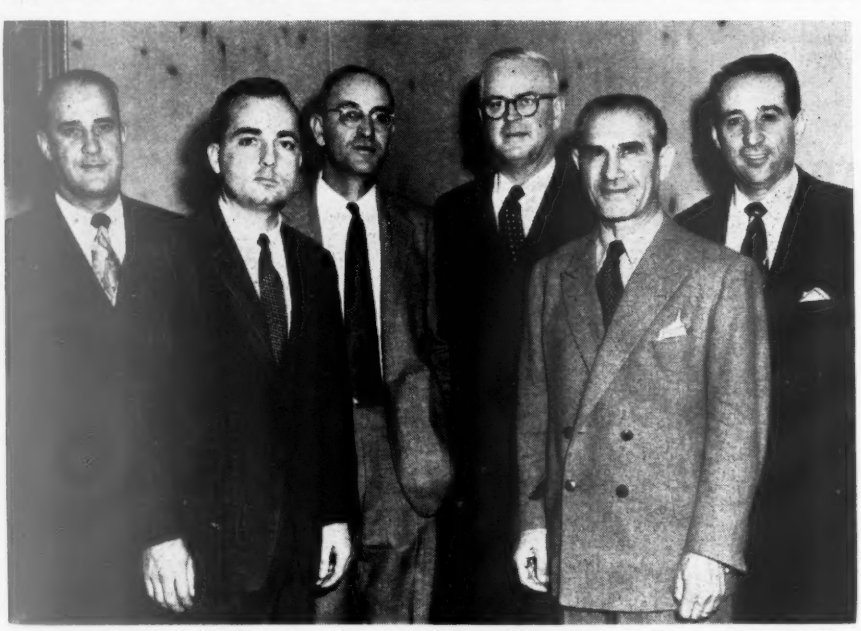


Officers for Houston Nomads Installed. The Shamrock Hotel in Houston was scene of the Nomad group's annual banquet and installation services. New officers are: E. F. Baldwin, secretary; Madden T. Works, assistant secretary; Harry E. Estes, executive secretary. Herschel J. Wood, president. Robert K. Franklin, vice president; Noble Endicott, regent; C. L. Clausel, treasurer; E. L. Lorehn, regent; Fred Christanelli, sergeant-at-arms, and Ed Louden, assistant, and W. L. Childs, assistant treasurer.



January guests of the Houston Nomads (above) are: Harry F. Simons, Weatherford Spring Company, Anaca, Venezuela; Maurice Genini, Societe Cherifienne des Petroles, French Morocco; M. R. Pitman, Creole Petroleum, Las Saninas, Venezuela; O. B. Rylander, Socony-Vacuum, Caracas, Venezuela; A. Heim, Houston; and Carmine Grossi, National Production Authority, Washington, D. C., main speaker of the meeting.

Harris Buys Extra Stock In Southern Geophysical

Dr. Sidon Harris, president of Southern Geophysical Company of Fort Worth, has purchased all of the company's outstanding stock, formerly held by National Geophysical Company and associates of Dallas. The price was predicated on a reported net worth in excess of $2,000,000.

Board of directors is now composed of Dr. Harris, chairman, R. H. Dana, W. D. Baird, R. E. Davis, E. F. Blake, L. R. Sarazen, and E. G. Aycock. Officers are: president, Dr. Harris; vice presidents, Dana, Baird Davis, and Blake; secretary, Sarazen, and assistant secretary and treasurer, Collins M. Burton.

Attending the February meeting of the Houston chapter of Nomads are: Eddie Dyer, Houston, main speaker; H. W. R. Wardlaw, Asiatic Petroleum Company, Houston; J. L. Lloyd of PEMEX, Poza Rica, Ver., Mexico; C. G. McDonald, CIMA, Houston, and Howard Pollet, Houston.

Dallas Geophysicists Meet

The Dallas Geophysical Society, local section of the Society of Exploration Geophysicists, sponsored a symposium on electromagnetic wave propagation in the earth at Southern Methodist University in Dallas recently. Chairman of the meeting was Dr. Daniel Silverman, of Stanolind Oil and Gas Company, Tulsa. The program included prepared papers by W. T. Born, of Geophysical Research Corporation, Tulsa; W. J. Yost and R. L. Caldwell, Magnolia; Dr. R. Maurice Tripp, Research Inc.; G. J. Baker, of W. M. Barrett, Inc., Shreveport; H. A. Morriss, Jr., and F. M. McGehee, Jr., of United Gas, Shreveport; W. C. Pritchett, Atlantic Refining.

Mangrove Tree Bark Said To Replace Quebracho

Clark and Cowden Oil Company and Viking Oil Corporation have perfected a process to use the bark from the Mangrove tree as a substitute for quebracho extract. The extract from quebracho trees—grown principally in northern Argentina and Paraguay—is used for treating mud, which cools an oil drilling bit, removes cuttings from the drill hole, and cakes the walls of the hole.

The U. S. oil industry uses an estimated 50,000 tons of quebracho extract a year, and it is getting increasingly hard to obtain. Victor Elkholm, founder of Viking, reports that the mangrove is inferior to quebracho in oil well drilling but contends the new treating process makes it superior. He calculated 150,000 tons of mangrove bark would be needed to match 50,000 tons of quebracho extract.

R. L. Clark of Clark and Cowden is in Panama to supervise the installation of a mangrove bark processing mill. He is financing the new Man Tan Chemical Company, Inc., which has a 25-year concession from the Panama government to obtain mangrove bark in the Darien region.

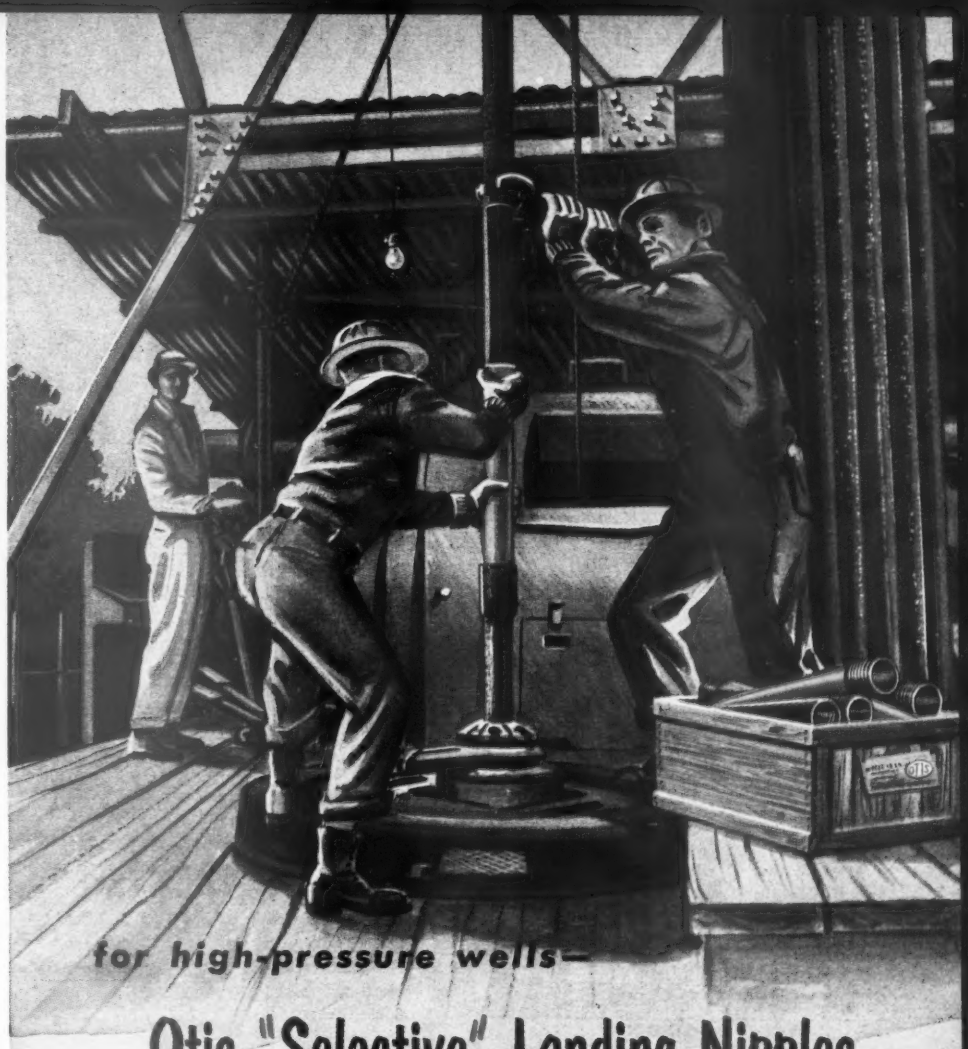
WORLD OIL PRODUCTION JANUARY TO JUNE 1951† (INCLUDING NATURAL GASOLINE)

COUNTRY	1000 metric tons‡
U.S.A.	161,000
Venezuela	43,300
U.S.S.R.*	20,500
Saudi Arabia	16,200
Persia	15,900
Kuwait	11,100
Mexico	5,600
Iraq	4,100
Indonesia	3,700
Colombia	2,700
Canada	2,600
British Borneo	2,500
Roumania*	2,100
Argentina	1,800
Trinidad	1,500
Egypt	1,200
Qatar	1,100
Peru	1,100
Austria*	900
Bahrein	750
Western Germany	600
Netherlands	350
Other countries	1,500
Total	302,100

*Estimates are necessarily somewhat conjectural.

†These data were compiled by the Petroleum Information Bureau of London, England.

‡Metric tons have an average of 7 bbl of oil.



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If your plans call for the completion or work-over of a high-pressure oil or gas well in the near future, ask an Otis representative to outline the many advantages of this special equipment for landing Otis sub-surface controls. Among the operating features he will explain is Otis' unique "selective" principle, wherein each Type S Locking Assembly is "keyed" to a Type S Landing Nipple. This keyed design allows a locking assembly to pass through all other nipples above until it "selects" its corresponding nipple. Thus two or three — or as many as five — landing nipples can be installed in the same string at different depths for the subsequent location of various Otis sub-surface controls as required. (If the flow is extremely abrasive or corrosive, it is recommended that an Otis Heavy-Duty Flow Coupling be made up above each nipple.) There are many more features — too many to describe here; but a few minutes' discussion with an Otis man today can hamstring your high-pressure problems tomorrow. Otis offices are listed below, and probably one of them is near your operation; if not, contact us in Dallas and we'll be glad to send you an illustrated bulletin and any other information you might want.

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WHAT'S DOING IN DRILLING

Largest Potential Given Well in Spraberry Trend

The No. 2 J. B. Calvary has been completed by Sinclair Oil and Gas Company in the Driver field, Glasscock County, Texas. Flowing from the Spraberry formation, the well was completed for a 24-hour flowing potential of 1191 bbl of 35.4 gravity oil through open 2-in. tubing. Gas-oil ratio was 980.1. At the end of the full 24-hour potential test, the well was flowing 49.5 bbl of oil an hour. The 1191-bbl-a-day potential is the largest ever reported for a well in the Spraberry trend.

New Mexico Well Deepened To 9500 Ft McKee Sand

DeKalb Agricultural Association and Magnolia Petroleum Company plan to deepen a Pennsylvanian failure in southeast Lea County, New Mexico. It is the DeKalb No. 1 Stovall, which was plugged and abandoned on total depth of 7955 ft. It will be carried to 9500 ft to test the McKee sand.

Skelly Well Produces 300 Bbl of Oil in 10 Hr

Skelly Oil Company has completed an exceptionally good oil producer in Stephens County, Oklahoma. It is the No. 2 Patterson, which was plugged back to 2299 ft, and swabbed 95 bbl of oil, without any water, in 24 hours. It then was treated with Sandfrac through perforations between 2036-52 ft and flowed 300 bbl of new oil in 10 hours through tubing, without any water.

Gets 4th Producing Zone

Anderson-Prichard Oil Company has reported two new producing zones in the old Moore field of northern Cleveland County, Oklahoma, which brings to five the total pay zones in the field. Latest well is the company's No. 1 Gross, perforated in Joins sand at 7911-23 ft. The new well flowed 11 to 12 bbl of oil an hour for 4 hours through a ¾-in. choke. Previously it had tested 60 bbl of oil a day, in the McLish at 7734-49 ft but this zone has been shut off.

Texaco Completes Well In Oklahoma County

The Texas Company recently completed a new well in Marshall County, Oklahoma. It is the company's No. 3 Chapman, which flowed 134 bbl of oil in 24 hours through a ¼-in. choke with a gas-oil ratio of 1100 to 1. It is producing from the McLish sand with perforations between 956-68 ft, and has a plugged back depth of 998 ft.

Naval Reserve Field Extended Northward

The Northwest Naval Reserve oil field of Osage County, Oklahoma, has been extended a half mile to the north. Extension well is the C. L. McMahon, Inc., No. 1 Cooke-Osage. The well was forced to shut in after the well filled a 200-bbl tank. Bartlesville sand was had at 2648-98 ft, total depth of 2707 ft. After a 200-qt shot of nitro in the sand zone, the well flowed 70 bbl of oil the first hour and was choked back.

Jasper Extends Field in Kern County, California

Jasper Petroleum Company has discovered oil at its Hubbard No. 1, an extension test in the Belgian anticline field in Kern County, California. The operator has set casing to bottom at 3832 ft and is preparing to complete. Phacoides oil sand has been logged at 4581-4602 ft, and Point of Rocks oil sand at 4783-4832 ft. A formation test of the Phacoaides showed a strong gas blow and 37 gravity clean oil.

Hamon Gets Gas Well In Rhode Gas Field

Jake L. Hamon has indications of a gas-distillate discovery at his No. 1 Rhode, in southeast Texas. The new well, which recovered 45 ft of distillate with bottom hole flowing pressure of 3225 psi, is in the shallow Rhode gas field. The operator is coring below 7474-89 ft. Two previous tests at 7466-74 ft and 7474-89 ft recovered distillate. Gas production in this area is found around 1700 ft.

Kansas Pool Extended

Cities Service Oil Company has extended the Eden Valley pool of Stafford County, Kansas, at its No. 4 Essmiller. On a drillstem test in the Lansing-Kansas City limestone at 3409-3435 ft, operations recovered 2040 ft of oil in one hour. Crews were drilling ahead at 3452 ft for the Arbuckle objective.

Deepest Producer Found In Permian Basin

Buffalo Oil Company has found the deepest production in the Permian Basin at its No. 12 B. M. Baish well in Lea County, New Mexico. The well is situated in the old shallow Maljamar field. It gaged 610 bbl of 47 gravity oil through open 2-in. tubing on a 24-hour test without acid treatment. Production is from the Devonian between 13,557 and 13,568 ft, total depth. The company's new well is in an area that produces from Permian limestone at about 4000 ft. Nearest Devonian production is in Saunders field, 20 miles northeast.

Spraberry Well Flows 381 Bbl of Oil Per Day

Honolulu Oil Corporation has a new well in the Spraberry field of southwest Sterling County, Texas. The well is the company's No. 1 Cope, which was given a completion potential of 381 bbl of 38 deg gravity oil a day through 5/16-in. choke from sand production between 5074-5120 ft. Flowing tubing pressure was 350 psi.

Second Well Drilled in Kentucky County Pool

The second Rosiclare-McClosky producer in the Onton North pool, Webster County, Kentucky, has been drilled by George and Wrather and associates. The new well is the No. 2 Mahurin-Luck, which produced at the rate of 8 bbl of oil per hour during swabbing tests. It is being put on pump.

Deep Test in Nigeria Fails to Recover Oil

Nigeria's first deep test well, now drilled at about 6500 ft, has no indications so far of finding production, according to Anglo-Iranian Oil Company, Ltd. The well is situated at Ihuo in the Niger delta, with operations being carried out by Shell D'Arcy Development Company of Nigeria, jointly owned by Shell and Anglo-Iranian.

Rotary Rigs Operating in Oil Fields of United States and Canada*

Weeks	Total	Gulf Coast	Pacific Coast	Illinois Oklahoma Kansas	Rocky Mountain Canada	New Mexico West Texas	North Texas
(January)							
Fourth	2879	592	169	578	333	723	304
(February)							
First	2924	586	170	621	343	712	324
Second	2854	574	170	571	330	724	328
Third	2882	579	173	601	334	713	322

*As reported to the American Association of Oilwell Drilling Contractors by Hughes Tool Company.

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Continental Deepens Well

Continental Oil Company is deepening the Braille No. 1, a well in the Newhall Townsite field, California. The well was completed last March for 100 bbl a day of 20 gravity oil for a new pool discovery.

Humble Hits 4th Level In New Mexico Well

The fourth producing level has been found by Humble Oil and Refining Company at its No. 1 Federal-Elliott, Lea County, New Mexico. The latest show came on a drillstem test at 13,121-178 ft in an unidentified sand and lime formation. Testing tool was open two hours. In a one-hour test through a 5/8-in. bottom hole choke, the well flowed distillate at the rate of 3 bbl of oil an hour. Gas-oil ratio was 56,585-1. Recovery when the tester was pulled was 75 ft of distillate in the drill pipe.

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Mississippi Field Well Flowing from Blake Sand

Midstates Oil Corporation has completed a new oil well in the Sibley field of Adams County, Mississippi. The No. 2 Ligon and Mazique flowed at the rate of 109 bbl of 42.8 gravity oil per day through 13/64-in. choke. Production was from casing perforations placed opposite Wilcox sands at 6422-23 ft. Hole has been bottomed at 6427 ft, and is cased to 6426 ft with 5½ in. pipe. Productive zone is the Blake sand.

Drill West Virginia Wells

Two oil wells have been completed in Harvey district, Mingo County, West Virginia, with a combined daily output of 25 bbl. E. C. Ware has completed the No. 3 Red Jacket Coal and Coke Company for 20 bbl of oil from the Big Injun sand at 1919 ft.

Carter Extends Oil Pool

Carter Oil Company has extended the Southeast Rich Valley pool in Grant County, Oklahoma. The new well, the No. 1 Mulkey Heirs, found production at 5528 ft and on 115 minute drillstem test registered 500,000 cu ft of gas. At the end of 110 minutes, the new producer showed mud and oil, and headed showing between 3 and 4 bbl of clean oil per hour. Crew set 7-in. at 5827 ft.

Elk City Well Completed

Shell Oil Company has completed its No. 3 Hutton in the Beckham County sector of the Elk City field, Oklahoma. From a plugged back depth of 10,516 ft, the well flowed 380 bbl of 62.2 gravity condensate in 22½ hours through a 3/8-in. choke from perforations between 9645-5 ft, 9670-80 ft, 9695-9710 ft, and between 9730-9811 ft. Gas-oil ratio was 9492 to 1.

Finds Oil in Gas Field

Humble Oil and Refining Company has found oil in the Little Lake gas area of Jefferson Parish, Louisiana. New well is the company's No. 1-F Louisiana Land and Exploration Company. It is situated three-fourths of a mile southeast of the nearest gas well. On a test from 11,276-79 ft, the well flowed at the rate of 297 bbl of oil daily through an 1/8-in. choke. Gas-oil ratio was 2200 to 1.

Gulf Oil Well Successful

Gulf Oil Corporation (et al) has found production at its No. 2 Mainka-Ring Unit in northeast Bradley pool, Grady County, Oklahoma. The well is Gulf's third operation in the pool. An offset to the original Bromide discovery for the field, the well test showed an estimated 2,350,000 cu ft per day at 11,926-981 ft.

Maysville Pool Gets Its Deepest Oil Producer

Cities Service Oil Company has completed the largest oil well in the Southwest Maysville pool of Garvin County, Oklahoma, to date. It is the No. 1 Weatherford, which is rated at 2184 bbl of 44.7 gravity oil a day. The Oil Creek sand, topped at 8240 ft, was perforated between 8306-36 ft, and the well flowed 86 bbl of oil the first hour. It then flowed 273 bbl of oil in three hours through a 36/64-in. choke and then 184 bbl in 5½ hours through a ¼-in. choke.

Deep Production Opened In Texas Oil Pool

Stanolind Oil and Gas Company has opened deep oil production in the Clinton pool of Harris County, Texas. Its No. 1 Bellnoski, Reels, and Trobough Survey, A-59, is shutin awaiting final potential gage after flowing at the rate of about 10 bbl of 30 gravity oil an hour through a ¼-in. choke on a drillstem test from 8541 to 8548 ft. Flowing pressure was 1500 lb, and gas-oil ratio was 975 to 1.

Alabama Field Well Drilled

The confirmation well to the shallow Hamilton gas field of Marion County, Alabama has been completed by Harry L. Cullet, independent operator. Flowing through 1¼-in. orifice plate, production was tested at the rate of 715,000 cu ft of dry gas per day. Flowing pressure was estimated at 60 to 80 lb. Production is from the Bethel sandstone topped at 1810 ft. Top of the porous zone was topped at 1816½ ft, and bottom of the hole is at 1820 ft.

Pure's Deep Well Testing

Pure Oil Company is testing the Lakota sand at West Poison Spider, Wyoming, after swabbing from Morrison-Sundance between 16,071-16,607 ft at the rate of 80 bbl per day. If it proves productive in the Lakota it will be the world's deepest producer. The well flowed at the rate of 80 bbl of oil per day, but it refused to begin flowing again. Pure topped the Lakota, at 15,862 ft, Morrison at 15,587 ft, Sundance at 16,160 ft. Good saturation and porosity was reported in cores of the Lakota, but the zone was not drillstem tested when drilled.

Pacific Supply Drills California Field Well

A fault block discovery has been made in the West Newport field in Orange County, California, at the Pacific Supply Cooperative's Surf No. 1. The well has been completed flowing 202 bbl of 27.5 gravity oil in 12 hours through 32/64-in. choke from the Surf zone. Importance of the discovery is yet to be determined. The day following completion the well died but later, following resetting of the tubing, it was swabbed in and flowed 98 bbl on a 12-hour gage.

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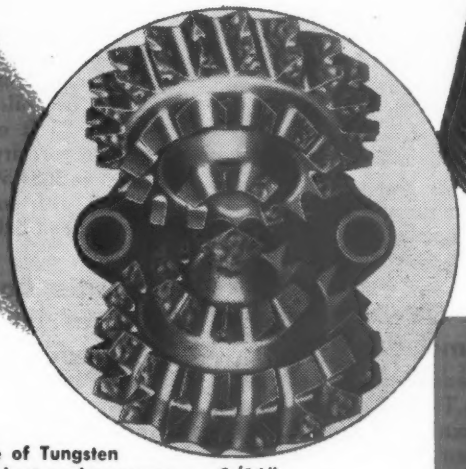
Although only recently announced, Globe "2-Cutter" Integral Jet Rock Bits have been thoroughly field tested with the cooperation of leading oil companies and drilling contractors . . . field tested for your assurance of greatest drilling efficiency.

Globe Jet Bits are now available in all popular sizes from 8½" to 15" in types SS2C, S2C, M2C, MH2C, and H2C.



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EXPLORATION ACTIVITIES

Danish-American Makes Jutland Oil Discovery

A new oil discovery has been made in southern Jutland, near Toender, Denmark, by the Danish-American Prospecting Company, a subsidiary of Gulf Oil Corporation. The company stated that this is "the first important result" of prospecting that began in 1938. Drill core samples were said to indicate some oil is present. It has not been determined as yet whether the oil is present in sufficient quantities for commercial production.

Richfield Makes Plans for Canadian Exploration

Richfield Oil Corporation is initiating an exploration program in the western provinces of Canada with district headquarters in Calgary, Charles S. Jones, president, announced.

Richfield is one of a group of shareholders in Trans Mountain Pipe Line Company, which will build a line from Alberta to the Vancouver area. Work on the project is scheduled to get underway this month.

The exploration program is scheduled to get underway immediately. Sam Stewart, geologist from the Los Angeles office of the corporation, is now in Calgary making advance arrangements for establishing headquarters.

Producing entirely within California at present, Richfield had a gross production of 28,093,000 bbl in 1951 and a net production of 21,401,000 bbl. Manufacturing operations are concentrated at its refinery at Watson.

Amerada Gets Fourth Well In North Dakota Area

Amerada Petroleum Corporation has reported its fourth oil well in North Dakota, about 5 miles northeast of its original discovery made last April. The well flowed 521 bbl of 42-gravity oil on a 24-hour test. Production was through a ¼-in. choke with 1150 lb pressure. Known as N.D. "A" No. 1, Amerada's new well is flowing from a lower section of the Madison lime from a depth of 8490 to 8512 ft. An additional producing zone in a higher section has not yet been perforated, but has been described as having good production potential.

West Virginia Flows 100 Bbl of Oil Daily

Dodd Oil and Gas Company has completed a 100-bbl producer in Sherman district of Calhoun County, West Virginia. It is the company's No. 7 Bennett, which has been completed at 2115 ft for 100 bbl daily on initial.

B-A Well May Prove New Julesburg Field

The British American Oil Company, Ltd., announces the discovery of what will undoubtedly prove to be a new field in the Denver Julesburg Basin area. Production was obtained from its wildcat well, Schwake No. 1, approximately 16 miles northeast of the Yenter field in north central Logan County, Colorado.

The well was completed for an initial production of 36 bbl per hour of 37.3 gravity oil from a depth of approximately 5300 ft in the "J" sand of Cretaceous age. Gas was also discovered at the location in the "D" sand at approximately 5160 ft where the well flowed on a formation test at a rate of between 3 and 4,000,000 cu ft per day. This completion represents the sixth discovery British American has made in the area.

Alabama Confirmation Test Fails To Show Oil Sand

Humble Oil and Refining Company has reported that its confirmation wildcat in the new Pollard field of Escambia County, Alabama, appeared to have missed the lower Tuscaloosa sand found in the discovery well, the No. 1 Moye. The Eutaw was found at 5170 ft, where coring began. The oil sand found in the discovery well was not found in the No. 1 Mrs. Lillie Congleton at 5920 to 5930 ft. In the meantime, Humble has staked location for its third test in the area, the No. 1 C. Brantley and A. Godwin Estate, about ½ mile south and ¼ mile east of the producer, now shut in after getting a potential of 338 bbl a day in the Lower Tuscaloosa at 5945 to 5971 ft.

McAlester Well Success

A new producing oil well has been brought in near Emerson, Arkansas. It is McAlester Fuel Company's No. 1 Sam McCollum, which is 6 or 8 miles from any other producer. The well flowed at 150 lb pressure, and was cut off after an hour and one-half to allow completion of the well. Travis Rowe, McAlester geologist, reported the oil began flowing when drilling reached the Petit lime formation.

Southwestern Oil Drills New Oklahoma Well

The new Southeast Keystone field has been opened in Tulsa County, Oklahoma, by the Southwestern Oil Company's No. 1 Stoneman-B. The new well, a wildcat, found saturated Red Fork sand at 1968 ft, and after fracture treatment responded for a steady flow of 60 bbl of oil a day.

Lion Completes Wildcat In Louisiana Parish

Lion Oil Company announced the successful completion of a wildcat well, known as the Maynard No. 1, Bossier Parish, Louisiana. Producing from two separate zones of the Rodessa gas horizon, the well has a potential of 27,000,000 cu ft of gas daily. Total depth of the well, situated just north of Barksdale Air Force base, is 5830 ft in the Travis Peak. Lion Oil has approximately 2000 acres in the block on which the well is situated.

Humble Discovery Well Completed in Texas

Humble Oil and Refining Company has a new discovery well in Reagan County, Texas, at its No. J-1 Sawyer Cattle Company. The well has been drilled to a total depth of 6744 with top of production at 5724 ft. Hydrafraced with 3000 gal, it pumped 70.39 bbl of oil a day through 2-in. at 5832 ft. Oil tested 38 gravity and gas-oil ratio was 238-1.

Salt Dome Gas Well Proves a New Discovery

A new gas discovery well has been completed at Salt Dome Production Company's No. 1 Vidal et al, A. Cantu Survey, Duval County, Texas. The new well gaged 6,300,000 cu ft of gas daily from 4532 to 4534½ ft plus 11.48 gravity bbl of 56.6 gravity condensate per 1,000,000 cu ft of gas.

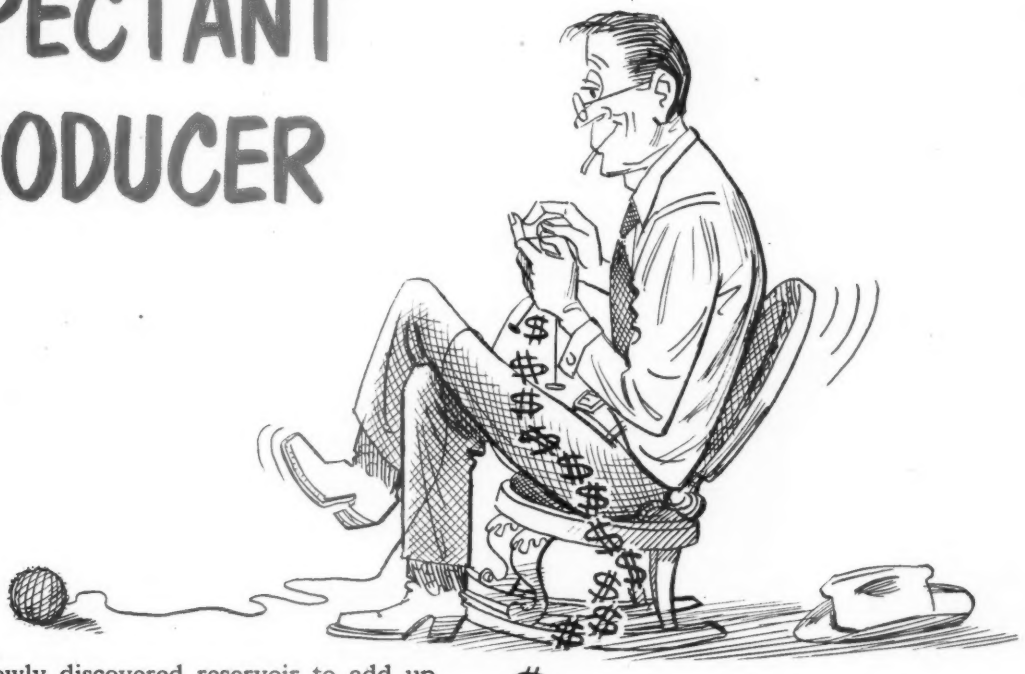
Williston Basin Well Has Good Oil Shows

Oil shows have been encountered at Shell Oil Company's No. 1 J. K. Winters in the Williston Basin of South Dakota, in Corson County. On a 160-minute drillstem test at 5578-5610 ft, 3 gal of mud were recovered with pin points of live oil. A core at 5609-34 ft recovered 25 ft of dolomite and lime, with some porosity and brown oil stain. At a test at 5634-59 ft, 20 ft of lime were recovered with some staining. Drilling is going ahead below 5894 ft in lime.

California Company Opens Arkansas Oil Field

A new oil field has been opened in southern Arkansas by the California Company at its No. 1 Burtan in Lafayette County. The hole was drilled to 9564 ft and casing set at 9379 ft. With pipe perforated at 7342-52 ft, the well flowed 279 bbl of oil a day through a ¼-in. choke, with gas-oil ratio of 235-to-1, and was completed.

THE CASE OF THE EXPECTANT PRODUCER



Expecting his newly discovered reservoir to add up — barrel for barrel, dollar for dollar? Perhaps. But it's a long pull from bottom of the hole to the bank.

There's a lot more to learn about a reservoir, other than the fact that it is commercially productive.

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PETROLEUM RESERVOIR ENGINEERING

East Pakistan to Drill Patiya, Chittagong Test

Search for oil in East Pakistan will soon be intensified when Pakistan Petroleum Limited begins its deep test well in Patiya, Chittagong district.

Preliminary work of constructing an approach to the densely wooded location, on the far side of the Karnafuli river, establishing a camp and bringing of more than 6000 tons of material is a considerable engineering job.

The company is planning to drill this test well to a depth of 14,000 ft if necessary, and its results will have a most important bearing on the oil prospects of East Pakistan.

Core hole drilling for geological information in Sylhet is already in progress and the first hole has been drilled to 1500 ft.

As reported earlier the objective in Patharia well was reached on December 11, and now the well is being prepared for tests of sands penetrated that gave some indications of gas or oil.

Texas Oil Field Opened

S. D. Johnson is opening a new oil field in Jack County, Texas, at his No. 1 Rater, six miles east of the Tex-Am field, nearest sand production. On drillstem test at 3240-50 ft, there was immediate blow of gas, with recovery of 2115 ft of oil, 15 ft of oil-cut mud, and 30 ft of brackish water.

New Well Drilled in Chapel Hill Field

Another completion for the Chapel Hill field of Smith County, Texas, was reported by Cities Service Oil Company, the operator. Warren No. 1 was completed for an open flow of 11,500,000 cu ft of gas through perforations in the Rodessa formation from 7446 to 7462 feet and 7512 to 7526 feet. Thirty-two barrels of distillate were produced with each million cubic feet of gas. The well was drilled to a total depth of 8398 ft, testing the Pettit and Travis Peak horizons.

Humble Discovers New Pool In California Oil Field

Humble Oil and Refining Company has a new pool discovery in the Castaic Junction field in Los Angeles County, California. The Newhall Land and Farming No. 8 has been completed and is producing 588 bbl of 29 gravity oil through a ¼-in. choke. Total depth is 11,080 ft. There is said to be 155 ft of oil sand in this well between 10,722 and 10,923 ft.

Shell Colorado Well Opens New Oil Area

Shell Oil Company has opened a new oil area in the Denver-Julesburg Basin at its No. 1 Rice. The wildcat, in Logan County, Colorado, has been drilled to around 5200 ft and perforated in the Dakota at 4870 ft. On initial test the well flowed 195 bbl of oil, no water, in 12 hours, and was shut in for tanks.

Phillips Well Indicates New Deep Oil Field

A new deep oil field is indicated for Garvin County, Oklahoma, at Phillips Petroleum Company's No. 1 Denson. On a drillstem test of sand at 8594 to 8620 ft, there was recovery of 305 ft of oil, and on a second test Phillips recovered 2883 ft of oil at 8620-45 ft. The sand tentatively is called the Hart, a prolific producer on the trend.

Kansas Reports New Field

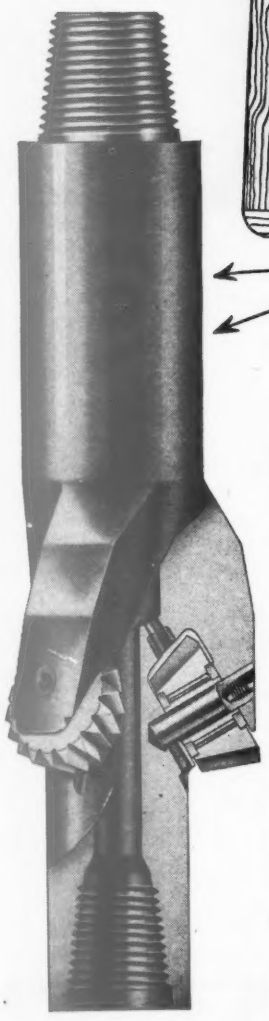
A new oil pool has been opened in Lyon County, Kansas, at Ellis and White's No. 1 Finney, one mile east of Ritchey-Moore field. The well is making an estimated 100 bbl of oil daily from the Mississippi lime.

Luke Grace Well Opens Pool

Luke Grace Drilling Company has opened a new oil field in Montague County, Texas. Pool opener is the company's No. 1 Millan, which flowed 15 bbl of oil the first hour on initial test from sand at 5635-53 ft, total depth.

Opens Consulting Offices

Carl F. Beilharz has opened geological consulting offices at 805 Southern Standard Building, Houston, Texas. He was formerly division geologist for Pure Oil Company in the Gulf Coast area.



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Roller Cutter Shale Bits	Bulletin No. 54
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New Discovery Seen for Beaver County, Oklahoma

Emby Kaye and associates of Tulsa, Oklahoma, have what may be a new discovery for Beaver County, Oklahoma. Good saturation has been found at their No. 1 Sid Sharp, indications of which are coming from the Pennsylvanian Cherokee section. Gas appeared within 6 minutes on a drillstem test taken in an interval at 5837-67 ft. It flowed at an estimated rate of 100,000 cu ft per day. Breakdown of the pipe after the test yielded 1850 feet of clean oil with an additional 150 ft of oil and gas-cut mud. Flow pressure increased from 200 psi at the beginning of the test to 225 psi at the end. Bottom hole pressure after the well was shut in registered 1900 psi.

Potter County Discovery Makes Small Gas Shows

Standard of Texas has had small gas shows at its No. 1 Bush in Potter County, Texas. In two tests taken at 4350-4415 ft, small amounts of gas, drilling mud, and salt water were recovered from the drillstem. Drilling is currently going ahead toward the projected oil depth of 6500 ft. Seven miles west is the Bush dome, which produces a high helium content gas within its small areal extent. Outside of this one structure, no production has yet been obtained from the Palo Duro basin lying south of the buried Amarillo mountains.

Illinois Pool Opened

A new shallow Cypress sand pool has been opened in Perry County Illinois, by Tom S. Doran and Ted Glass. Pool opener is the No. 1 Zudinski, which flowed at the rate of 80 ft per hour after plug was drilled. The well is being put on pump for completion, and operators estimate it is good for 50 bbl of oil per day. Total depth is 1136 ft.

Magnolia Well Success

Magnolia Petroleum Company's No. 1 University of Texas, Andrews County, West Texas wildcat has proved production in the Devonian formation. The new well flowed 49 bbl of 42-gravity clean oil the first hour and 57 bbl in the second hour on a drillstem test from 12,552-572 ft. The Devonian was topped at 12,550 ft. Magnolia's well is 11½ miles east and slightly north of Andrews, and 9½ miles west of the nearest Devonian producer.

New Mississippi Field

B. Serio-J. Paul Ratcliff, Jr., are completing their No. 1 Frances Geddes, a Wilcox discovery near Jackson, Mississippi, to open the new Moorland field. On a drillstem test at 6335-38 ft using ⅜-in. bottom and ¼-in. top chokes, fluid was to the surface in 15 minutes. Through a 10/64-in. choke, the well flowed at the rate of 12 to 14 bbl of oil per hour with top pressures of 725 psi. Testing to tanks is continuing.

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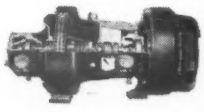

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Running tour with men in the industry

W. E. Winn has been named manager of the exploration and production division of Southern Natural Gas Company. He has been moved from Dallas, Texas, to New Orleans, Louisiana. Winn joined Sun Oil Company in 1922, upon graduation from Texas A & M College. He was assistant manager and chief engineer of Sun's gas department, when he joined Aetna Oil Company as vice president in 1947. Following merger of Aetna with Ashland Oil and Refining Company in 1950, Winn became Gulf Coast representative for Ashland.

Jerry Kyle has been named district geologist for Carter Oil Company at the new district office recently opened at Miles City, Montana, in the Williston Basin area. **Harold R. Drange,** Denver, Colorado, is the new landman, and **Leo P. Sas,** district scout. Dick Morehouse, geologist at Casper, has been handling work in the Basin. O. C. Schorp, Carter president, announced the change.

C. Ivan Alexander

Dr. C. Ivan Alexander has been named supervisor of exploration research at Magnolia Petroleum Company's field research laboratories in Dallas, Texas. Alexander succeeds **Dr. Dayton H. Clewell** who has been named director of the laboratories. Both appointments were effective March 1 when **T. W. Nelson,** present director, became associate director of Socony-Vacuum's laboratories with headquarters in New York.

Dr. Alexander received his Bachelor of Science degree in geology from Texas Christian University in 1924 and his Master's degree from the same school two years later. He received his doctorate degree in geology from Princeton University in 1928 and for the next five years was assistant professor of geology at TCU. He first joined Magnolia as a paleontologist in the company's Shreveport offices in 1933. In 1948 he was moved to San Antonio from Tyler, Texas, as head of the San Antonio geological district and later was transferred to the Dallas general offices as a regional exploration geologist.

Richard K. Huey

Richard K. Huey, well-known figure in oil production circles, has announced that he is entering business for himself in Tulsa as a petroleum consultant and gas company owner.

The long-time production vice president of Deep Rock Oil Corporation, will open offices in the Atlas Life Building to carry on his new activities. He will conduct an advisory and management service for oil and gas development and operation. This includes representing non-operating partners in oil and gas production operations.

In addition, Huey is organizing the Cimarron Gas Company which will operate a gas transmission system in Payne and Lincoln counties, Oklahoma.

Huey has been identified with Deep Rock production activities for 31 years. In 1941 he was elected a vice president of the company and in June of last year, he became assistant to Deep Rock's president, W. H. Garbade. He received his education at University of Chicago.

Ernest V. Potter, Tulsa, Oklahoma, has been named district land man for Sunray Oil Corporation at San Antonio, Texas. Potter has already taken charge of Sunray's office in San Antonio's Milam Building. He has been most recently associated with Skelly Oil Company, in the Skelly legal department 1937-49, and was a representative in the land department of Skelly Oil for the past two years. Potter is a graduate of the University of Kansas, and holds a Bachelor of Law degree from Cumberland University. He is a member of the Tulsa Land Man's Association.

Luther H. White has been appointed chief geologist for McElroy Ranch Company, Fort Worth, Texas. White has been with Sinclair Oil and Gas Company for the last five years. He is a graduate of the University of Oklahoma, and has been associated with B. G. Goble, Oklahoma Central Oil Company, Sunray Oil Corporation, and Deep Rock Oil prior to going with Sinclair. White was president of the Fort Worth Geological Society last year.

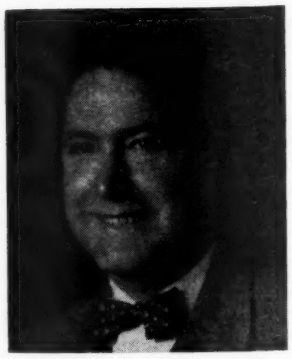
James F. Neill has been promoted to general superintendent of drilling and production, West Texas division of The Texas Company's producing department. Neill, a native of Denver, Colorado, is moving up from assistant to the division manager and will remain in the division office at Fort Worth.

After graduation from the Colorado School of Mines with the BS degree in 1935, he joined The Texas Company as a roustabout. He became junior petroleum engineer at Crane, Texas, in 1938, and head roustabout the next year at Monument, New Mexico. In 1947 he was advanced to assistant district superintendent at Midland, Texas, then was transferred to Fort Worth as assistant to division manager in 1949.

F. F. "Jack" Badger has been promoted to area landman for the San Antonio, Texas, office of Deep Rock Oil Corporation. Badger received his college training at St. Edward's University and the University of Houston. He had a number of years experience as a scout prior to joining Deep Rock in 1950.

Robert A. G. Joseph has been hired as scout in the San Antonio office to fill Badger's previous position. Joseph was born in Zurich, Switzerland, and was educated in that country and England. Before joining Deep Rock, Joseph had experience in Mid-Continent oil fields.

J. A. Mussler, Continental Supply Company, Dallas, Texas, was elected president of the Dallas-Fort Worth Chapter of Nomads at a meeting held



J. A. Mussler

recently. He will serve during 1952. Other officers elected were: **E. F. (Gene) Shiels,** International Derrick and Equipment Company, vice president; **M. W. Hiltpold,** Buda Engine and Equipment Company, secretary; **K. B. Winstead,** Oil Well Supply Company, assistant secretary; **R. E. Davidson,** *Drilling Magazine,* treasurer; **M. F. (Mike) Hazel,** Oil Well Supply, assistant treasurer; **C. R. (Cliff) Athy,** Ideco, sergeant-at-arms, and **Lloyd E. Tracy,** Oil Well Supply Company, deputy sergeant-at-arms.

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1. **Bakersfield, California.** Operator had spent three days trying to drill by junk at approximately 12,000 feet.	McCullough Bottom Hole Jet Cutter.	Junk eliminated, well completed without further trouble. TIME ON JOB: 4 HOURS!
2. **Lake Charles, Louisiana.** Too much cement behind 7" O.D. 23 lb. casing at around 6700' for two competitor's guns to penetrate. Operator stated this was last chance to make a well.	McCullough Glass Jet Perforator with Steel Strip Carrier. Six holes shot in two foot zone.	Production 50 B/D after perforating! TIME ON JOB: ONE HOUR!
3. **McAllen, Texas.** One string of 5½" 15 lb. casing, squeeze cemented several times, resisted attempts of two competitors' bullet and largest jet guns.	McCullough Glass Jet Perforator with Steel Strip Carrier and McCullough Burrless Bullet Perforator. 204 Burrless Bullets. 102 Glass Jet charges. Total of 306 holes shot in 51' zone at around 8000'.	Production 37 B/D after perforating. TIME ON JOB: 6 HOURS!
4. **Edmonton, Canada.** Drilling crew in attempting to set surface casing discovered several large boulders had blocked the hole. After several days trying to drill past boulders, abandoning seemed necessary.	McCullough Bottom Hole Jet Cutter.	Three boulders were eliminated: at 21', 32', and 55'. TIME ON THE JOB: 3 HOURS!
5. **Ventura, California.** The 4¼" drill pipe was stuck in this 8,000' well. Oil Operator spotted oil around the drill collars for several days without results.	McCullough Magna-Tector.	Free point was located at 400' above the drill collars. Oil was spotted at that point and pipe came loose in TWO HOURS!
6. **Odessa, Texas.** This 12,000' well with one string of 5½" casing, cemented, could not be penetrated by several competitors' guns.	McCullough Glass Jet Perforator with Steel Strip Carrier. 180 holes shot.	Production 1300 B/D after perforating! TIME ON JOB: 8 HOURS!

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To obtain more information on products advertised see page E-41

▸ **A. C. Rubel,** of Union Oil Company has been elected president of Petroleum Production Pioneers, and **A. E. Fowks,** retired Union Oil Company executive was elected honorary president.

Other officers elected were, **Earl M. Daniels,** Hydril Company, vice president; **T. J. Hickey,** Hickey Pipe and Supply, honorary vice president; **G. S. Follansbee, Jr.,** Universal Consolidated Oil Company, treasurer; and **R. Sneddon,** secretary.

L. B. Little, retired Standard Oil Company executive, in behalf of the members of the organization, presented the outgoing president, **L.L. Aubert,** a gold mounted gavel as a memento of his term of office, at the meeting of the board of directors recently. The latter in turn presented illuminated scrolls to **R. A. Broomfield,** former Barnsdall executive, the outgoing honorary president, and **Fritz Huntsinger,** president of the Ventura Tool Company, outgoing vice president.

▸ **John S. Russell,** formerly production foreman in Magnolia Petroleum Company's Falfurrias, Texas, district, has been promoted to assistant district superintendent of the Falfurrias district.

William C. Crone has been promoted from gang pusher to assistant foreman in Magnolia's Electra district.

Charles W. Hickok has been transferred from Magnolia's Panhandle district with headquarters at Pampa, Texas, to the Electra district as petroleum engineer.

Charles L. Barney, Ralph D. Burks, Ernest R. Frazier, and **James E. Leonard** have been transferred from Magnolia's Kermit producing district to the newly formed Pegasus district in West Texas as petroleum engineers. Also transferred from Kermit to Pegasus were **A. W. Shaw, Jr.,** and **Clarence Wells, Jr.,** as petroleum engineering assistants. All these men will be under the supervision of Leonard O. Franklin, district petroleum engineer, Pegasus.

Robert B. Wing

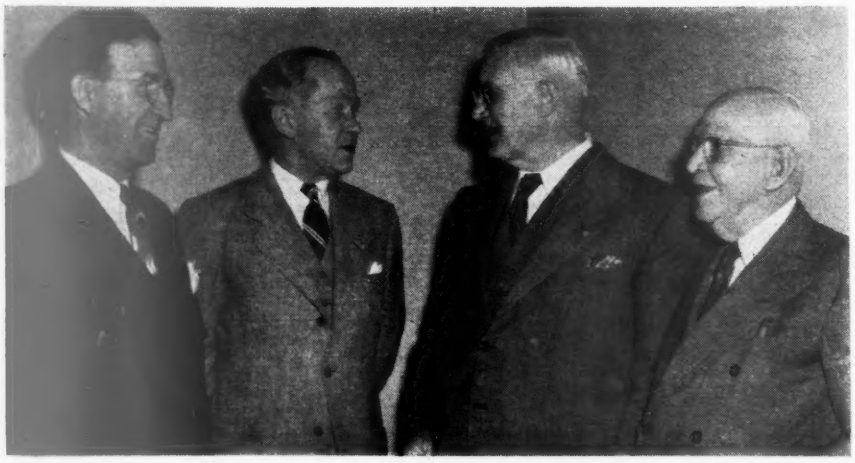
▸ **Robert B. Wing** has been named division geologist for Shell Oil Company in the Rocky Mountains.

Formerly from the company's Tulsa area, Wing succeeds **Alex Clark** who resigned. Born in South Dakota, Wing attended college in Minnesota and St. Louis where he received his B.S. degree from the University of Minnesota and Master's degree in geology from Washington University.

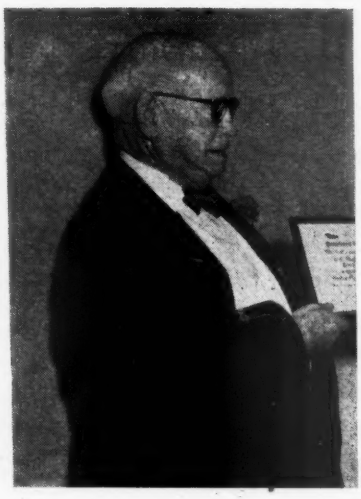
He first joined Shell in 1934 as a field geologist in Oklahoma. Later he became a subsurface geologist in the Tulsa and Wichita Falls offices. In October 1941 Wing was called into the service and served 18 months overseas with the Third Army, rejoining Shell's area exploration staff in Tulsa, in 1945. Later he spent six months in the Houston exploration and production office.

▸ **Paul Lyons** has been named exploration manager of Anchor Petroleum Company, Tulsa, Oklahoma. Lyons has been staff geologist of The Carter Oil Company for the last 17 years. A graduate of DePauw University, Lyons began oil work with Humble Oil and Refining Company in 1934 and was transferred to Carter in 1935. He is editor of "*Geophysics*", the publication of the Society of Exploration Geophysicists.

New Officers for 1951. Petroleum Production Pioneers' new officers include Earl M. Daniels, Hydril Company, vice president; G. S. Follansbee, Jr., Universal Consolidated Oil Company, treasurer; T. J. Hickey, Sr., Hickey Pipe and Supply Company, honorary vice president; and A. E. Fowks, retired Union Oil Company executive, honorary president.



Fritz Huntsinger, president of Ventura Tool Company, left, receives scroll during annual meeting of the directors of Petroleum Production Pioneers. Huntsinger was vice president in 1951. R. A. Broomfield, former vice president of Barnsdall Oil Company, center, is awarded illuminated scroll as momento of his term of office as honorary president of Production Pioneers during 1951. Lin Little, production executive of Standard Oil California and charter member of Production Pioneers, presents L. L. Aubert a gold mounted gavel from the board of directors and members. Aubert, president of Bankline and Norwolk Companies, is past president of the Pioneers.



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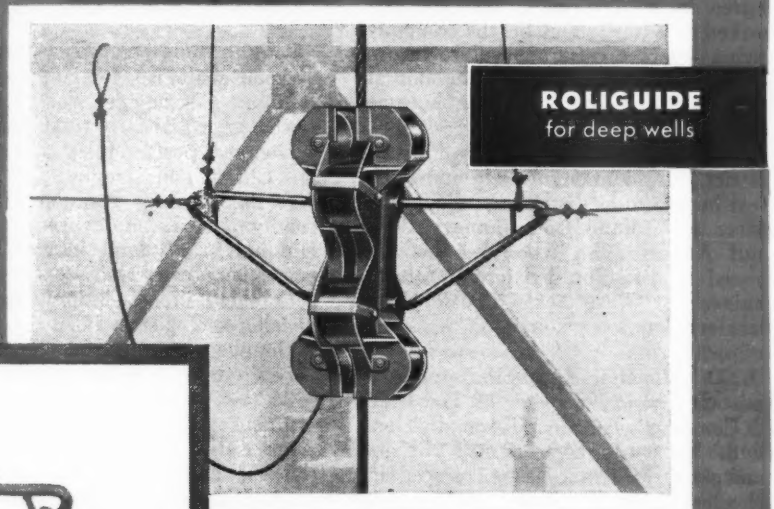

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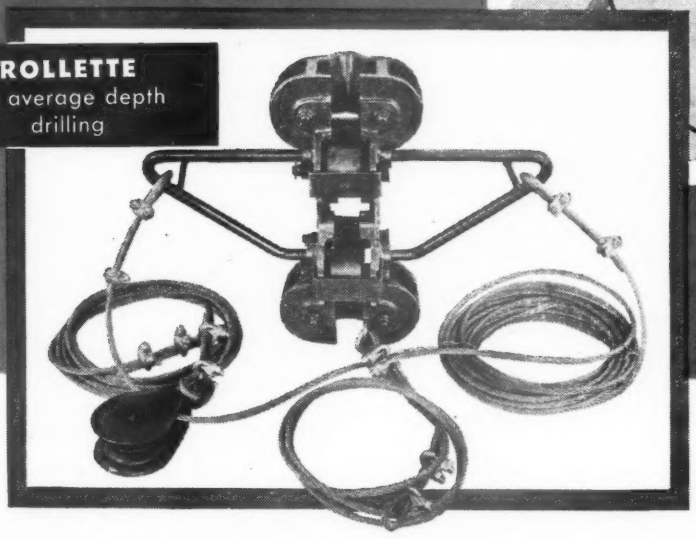

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D. L. Harlan has been promoted to assistant chief petroleum engineer, producing department, The Texas Company. Harlan, who will move from Fort Worth to Houston, will be succeeded as division petroleum engineer, West Texas division of the producing department, by **G. R. Brown.**

Harlan joined The Texas Company in 1933 as a rotary rig helper at Port Neches, Texas, field after graduating from the University of Texas with a B.S. degree. He was transferred to Houston as a clerk a few months later, then was made junior petroleum engineer, South Texas division, in 1935.

Brown was graduated from California Institute of Technology with the B.S. degree in applied chemistry. He first worked as a roustabout for the company during summer vacations before beginning a regular job as a roustabout at Midland, Texas, in 1940. He became petroleum engineer at Midland in 1946, then was transferred to Wichita Falls as district petroleum engineer in mid-1947. Next he served as district petroleum engineer at Midland from January 1950, until August 1951, when he was advanced to assistant division petroleum engineer of West Texas division and transferred to Fort Worth.

J. D. Wheeler has been appointed assistant division manager of The Ohio Oil Company's Houston, Texas, division. **C. S. Mills** has been named district manager at Midland, Texas, succeeding Wheeler. **D. W. Franklin,** geologist at Abilene, Texas, succeeds Mills as district geologist at Midland.

First employed by Ohio Oil in 1932 as district petroleum engineer in East Texas, Wheeler moved to West Texas in 1934. He was appointed division engineer at Tulsa in 1937 and later that year transferred to the Houston division in the same capacity. He was promoted to division manager at Grand Rapids in 1946 and district manager at Midland in 1948.

Mills joined the company as a geologist in Texas in 1935. After completing geological assignments in Texas, Louisiana, and Florida, he was transferred to Midland as district geologist in 1947.

Franklin became associated with Ohio Oil's geological staff in Indiana in 1939. Entering military service in 1942, he returned in 1946 as a geologist at Wichita Falls, Texas, and was transferred to Abilene in 1948.

Vaughn Maley and **W. E. Dougherty,** division geologists for Humble Oil and Refining Company's West and Southwest Texas divisions respectively, have exchanged posts. Maley going to Corpus Christi and Dougherty to Midland.

A 1926 geology graduate of the University of Texas, Maley went to work for Humble in Midland in 1927. He has been there ever since, except for one year spent in Mississippi. He became division geologist in 1941.

Dougherty received his degree in geology from the University of Texas in 1936. He, too, joined the company in Midland soon afterward, and had become assistant division geologist by the time he left in 1942. At that time he entered the army. After his discharge, he returned to Humble at the same post and worked in Midland until 1948, when he went to Corpus Christi as assistant division geologist. Later in 1948 he was named division geologist there.

John McEwen

John McEwen became affiliated with the Contractors Statistical Committee as consulting engineer recently. This is a group of approximately 30 California Oilwell Drilling Contractors who formed this committee for the accumulation of operational information on drilling. Current statistics for active drilling areas are maintained for the benefit of the industry. After receiving a degree from the University of Pittsburgh in mechanical engineering in 1919, he spent several years in the steel stamping industry. In 1921 he affiliated with Lee C. Moore Corporation where he became chief engineer. In 1930 he transferred to Ideco at Columbus, Ohio, as chief engineer and in 1931 was transferred to their Torrance, California, plant as manager of engineering and production. Subsequently he became vice president and general manager of their California division.

Stan Hardison, district geologist for Kerr-McGee Oil, Inc., has been tranferred from Panhandle district at Sunray, Texas, to Midland district at Midland.

New officers for 1952 singing Tulsa, Oklahoma Nomads inaugural song are: Opie Dimmick, Century Geophysical, president; R. E. Kirberger, Unit Rig and Equipment, vice president; Gilbert Swift, Well Surveys, Inc., secretary; J. S. George, Hughes Tool, assistant secretary, Arch Campbell, General Motors Company, treasurer; R. C. Glover, Baker Oil Tools, assistant treasurer; J. H. Beesley, Baroid Sales Division, sergeant-at-arms; H. M. Cooley, Bethlehem Steel, out-going president and regent; Don L. Collins, Republic Supply, deputy sergeant-at-arms, and G. F. Coons, National Tube, regent.

T. G. Hanlon, Pan-Am Southern Corporation

C. M. McKinney, Bureau of Mines

R. B. McHenry, Gulf Oil Corporation, chairman, presiding

Leland C. Newton, Skelly Oil Company

Paul D. Williams, technologist, WPRA, Tulsa

R. O. (Dick) Bender, du Pont Company

Applied Psychology and Management

THROUGHOUT the history of the petroleum industry, especially during the half of the current century just closed, a tremendous amount of attention has been given to the science and the engineering of exploration, production, and manufacturing of petroleum products. The properties of petroleum and its fractions, peculiarities of geologic formations, methods for exploring, drilling, and for producing petroleum and natural gas have been studied without ceasing. The assembled and systematized knowledge of the world on these subjects fills huge libraries, the application of this science and the gaining of more knowledge occupies the attentions of tens of thousands of our best engineers, chemists, physicists, geologists, and other scientific men.

By so doing a great deal of all-important information has been compiled and arranged, and made available to apply in the furtherance of the industry's aims and purposes. Many developments from other industries, and from pure scientific activities have been adopted and adapted by the oil industry to improve its own operations, as for example the use of radioactive tracers to follow subsurface operations; the utilization of fractionation principles first employed mainly by the fermentation, and the coal-tar industries.

During most of this period, little if any *concerted* attention has been given to the "science" of the human personnel, the management, training, and directing of the staffs that have made all these operations possible. Fitting of individual to job has been largely a hit-or-miss proposition, a system of elimination in which the individual either fitted himself to his job or was eliminated from the payroll, or shifted elsewhere to a different or the same type job. Little if any chance existed for a man to learn the requirements of a new job except by the doing of it, a haphazard and time-consuming method, the guild system of the Middle Ages obtained in most cases.

More recently these conditions have changed rapidly and all for the better, taking into consideration all matters of moment in the management of plants and personnel, especially during the last 15 years the scientific approach to the multitudinous problems of personnel management, direction, training, and choosing of personnel for the hundreds of different types of jobs in the refinery, field, and sales organizations. The results are that the present-day oil company employee has more general and specific training for his type of job than any industrial employee has had in all human history. He has more open avenues of approach to his management on grievances and problems; he has more opportunities to try for advancement, to improve his technical knowledge and techniques of operation than any man ever has had, and he is more carefully watched by his superior officials for evidences of hidden or developing abilities, for fitness for advancement, than any workman or technologist ever has had. It is doubtful if the mass of refinery and similar employees are fully conscious today of the tremendous advantages they enjoy, traceable directly to the efforts of superiors to bring out the best in them, to give them a fair "break," and to train them for the most efficient service.

All the resources of business management principles, of applied psychology, as well as the knowledge and new developments in science and engineering are called into play to further these ends. In the higher technical brackets we are reminded of the educational and training programs employed by many companies, one of the most outstanding of these being that of Humble Oil and Refining Company discussed in these pages sometime ago (September, 1949, page C-7). Similarly, general refinery personnel training programs are utilized to improve overall plant operations and employee morale and efficiency, such as the routine developed and used by Socony-Vacuum at East Chicago (Refining and Gas Processing, February, 1949, page C-7).

Systems such as these, begun independently by some of the larger and most forward-looking companies, have become typical in general throughout the greater number of refining companies. This trend is typified by the discussions in a far-reaching meeting of The Western Petroleum Refiners Association early in February. Here a number of leaders in this employee-training and employee-relations field discussed their methods and the results being obtained, in a most informative manner.

Four steps are employed in the training of supervisory personnel, according to E. W. McNeil, training department director for Esso Standard Oil Company at Baton Rouge, Louisiana. These four steps are: 1. Orientation, 2. management skills, 3. human relations skills, and 4. technical skills. Employees selected for training as supervisors are first introduced to "top management" by visits to executives, during which visits they are shown the company's policies, methods, and other indoctrination matters as part of the plan for educating these people for supervisory positions. Normally about one day is devoted to the indoctrination of these supervisor candidates, a time that is considered all too short for the purpose. Following this introductory work a group of 12-15

supervisors go on an orientation tour of the entire plant, which lasts a week or more. All divisions of the plant are visited, and the class learns how all are tied together into the unified whole that makes up the refinery organization. This routine includes study of public relations, the position of the supervisor in the company's structure; it also includes study of laws with which the supervisor is required to be familiar, knowledge of which is necessary to discharge of his more advanced future duties. The last day of this training period is devoted largely to more intensive study of and broader acquaintance with the company policy, intimate knowledge of which is needed for the supervisor to manage his new job properly.

In this company a system has been developed with Louisiana State University, which is near the refinery, for a week's course in work planning, in job instruction, and similar phases of the employee's new field. Admittedly a week's time is inadequate to give the men complete training, but does aid in establishing them as supervisors, to crystallize their thinking and to instruct them in the rudiments of the new work. The age-old pedagogic principle of continued repetition is employed to fix facts and ideas in the students' minds.

For the fourth training step, on technical skills, it is accepted as a fact that the supervisor need not necessarily be an expert in the actual work for which he is supervisor head. He gains this expertness as time goes on and also gains supervisory skills by the exercise of this capacity. It is believed that the major part of the early training work should be devoted to the first three of the steps mentioned.

Further in the plan for training supervisors for advancement, a rotational system is employed. The student is given complete authority *and* responsibility over a given operation or unit of work to be supervised, and the method of carrying out the job is observed by management. This gives excellent training in actual managerial work and responsibility. More than one such job is assigned usually. Courses of such instruction and practice are directed largely to mechanical and process supervision. Under normal procedures technical people are not included in these training routines. Top management, division heads, and subheads are used as leaders in meetings held from time to time, in between "discussion" type meetings and "lecture" type meetings.

"Salary Grade" Systems

More systematic attention is being given also to salary gradations, to raises and promotions among plant employees than was formerly the case, according to T. G. Hanlon, industrial relations manager for Pan-Am Southern Corporation. In this company in which Pan American Petroleum and Root Petroleum Corporations were merged recently, in an organization of more than 1500 direct employees and twice that many indirectly as staff men in bulk plants, stations, etc., some 800 people are included under an eleven-grade salary plan. This plan covers salaries ranging from about $162 to about $775 per month. Beginning with mail clerks as No. 1 grade in the system, a 30 per cent salary range is arranged in each grade. Sometimes intermediate, junior, and senior grades are provided in some classes. Originally the system provided for all salary changes to occur on January 1 of each new year, a plan which showed serious disadvantages. Some employees would appear on raise lists without deserving it, some would be overlooked. Later the raise plan was spread throughout the year, on the first of the month following the anniversary of employment of the individual. The problem and work of arranging for these raises have been spread over a greater number of administrative people, to insure proper handling and to minimize errors. A salary executive committee, which includes the company treasurer and comptroller, controls all salaries. Employees adjudged to deserve raises receive 5 per cent of their salary, or $10 minimum, whichever is the larger amount. No employee receives a raise who has had a raise within four months prior to the time during which raises are being granted. Salaries above the maximum or below the minimum of each grade must be approved by the salary executive committee before they can be granted. The head of each division or department makes an estimate of the budget required for raises during a whole year. This is in order that the budget not be "consumed" too early, thus preventing some from receiving raises or promotions on account of exhaustion of the appropriation for this purpose. The annual salary budget must be approved by the company's board of directors before it becomes official. A typical salary raise budget is two to three per cent of the total budget. Promotional increases in salary are handled mainly in the same manner as are merit increases.

New Employees, Labor Relations

Many refinery organizations are employing only high school graduates or people of higher training, as far as possible for most jobs in the plant, such as the policy employed by Skelly Oil Company, says L. C. Newton, personnel and safety director for that company. Other companies test prospective employees via a "battery" of tests, methods that have been developed by leading psychologists and educators, many of them in full or part-time company employ. Mechanical aptitude tests are applied yearly to thousands of employee prospects, their nature determined by the type of job for which the man is being examined. Mathematical tests for example are based on the kind of arithmetic, etc., that may be required in the work of the refinery.

In employee-company relations, elaborate systems have been developed governing the hearing disputes, settlement of employee grievances, and when possible the resolution of aggravated questions that may lead to strikes. In the Skelly company, either labor or management may bring up a problem for arbitration. The decisions of the arbitration board serve largely as precedents for settlement of like problems arising later, it is understood.

Although this brief survey touches only a few of the high spots of currently employed training programs and labor relations in the refining and gas processing industries, the information given shows indubitably the careful and meticulous attention being given to more adequate training of personnel for the jobs to be done, for the promotion of deserving, capable, and ambitious men, and for improvement of relations between employee and employer. Fortunate is the employee who recognizes the tremendous advantages he enjoys for advancement, for study and learning bigger jobs, and for exercising his capabilities to his greatest capacity, advantages without equal or parallel in the entire history of the world, present or past.

* * *

J. L. (Doc) Parker, Girdler Corporation; Bruce Williams, Canol Refining Company, Church Point, Louisiana; Dr. V. A. Kalichevsky, Magnolia Petroleum Corporation, dinner speaker at Beaumont; and C. M. McKinney, Bureau of Mines, Bartlesville, Oklahoma.

DESIGN OF GASOLINE PLANTS

PART 4—THE ARRANGEMENT OF THE ELEMENTS OF THE PIPING SYSTEM

O. L. LEWIS*

PLANT-LAYOUT sets the location of the plantsite and the arrangement of the units within the plant. Equipment-layout is the phase of design covering the arrangement of the equipment within the units. Piping-layout is more detailed. The arrangement of individual lines connecting the equipment is then primary. The view is constantly narrowed to bring additional detail into the design-picture. The location and arrangement of the elements of the piping-system. are now considered.

Vents and Drains

"Drain all low points, vent all high points," is a phrase commonly found in piping specifications. Vents are required for several reasons. The high point in a gravity line may be vented to prevent siphon effect. Hydrostatic testing will not be complete unless vents are opened to let the trapped air escape. It is not safe to cut into a hydrocarbon-line for repair-work until all gases are purged from the line. At times, it is desirable to have a means of relieving the pressure on a line before valves or equipment are removed. The smallest vent used is ½-in. A ¾-in. minimum is required by most companies. If the line is big and a large volume of air or gas is to be vented, the size must be increased accordingly. Any connection larger than 1½ in. should be considered as an operating part of the plant and shown in the flow diagram.

Drains are the low-point equivalent of high-point vents. Test-water must be completely drained before the plant is put in operation. Heavy gases and inflammable or toxic liquids must be drained after a shut-down before maintenance work can begin. Lines containing steam must be provided with a means of removing condensate during operation. If the quantity is small and infrequent, a valved drain will do. If larger amounts of condensate are anticipated, the same connection will serve a steam-trap. All water and steam lines must be drained completely during shut-down periods if there is any danger of freezing. The size of drains depends entirely on the volume to be drained and the time available. Drains are ¾-in. minimum size in a 2-in. or larger line. Scale or dirt accumulated in the low-point of a line, may completely block a smaller connection.

Vents and drains may have any of three purposes and the valving varies accordingly. If the connection is to be used only when the plant is shut down, no valve is needed. A removable steel plug is satisfactory—it is a definite leak-proof closure and is more economical than a valve. If the connection is to be used with the plant in operation, but could be plugged if the valve developed a leak, then a single valve is satisfactory. If the vent or drain must be used to continue plant operation, then double valves are required. When double valves are used, particular attention should be paid to the support of the connection.

Control Valve Settings

The piping designer has a great deal to do with the effectiveness of automatic control. When automatic-control valves first came into use in steam systems, no particular attention was paid to how they were installed. And trouble moved right in with them. Then the steam-plant engineer, who has always been a conservative soul in the eyes of the petroleum industry, went overboard in the opposite direction. In power-plant piping, we not only have manual bypasses but sometimes dual installations of automatic valves, strainers in front of both valves, bypasses around each strainer and a bypass around the entire setting just in case everything else should fail. Usually gasoline plant operation is not so critical that manual operation cannot be resorted to in case of damage to the automatic controller. This does not mean that we should not do all within economic reason to provide for continuous operation.

Some of the points to keep in mind in the arrangement of control-valve settings are: (1) Accessibility for adjustment; (2) piping arrangement to minimize the possibility of scale and dirt damaging the valve-parts; (3) convenient manual bypass for use when required; (4) convenience in removing the valve from the line when necessary; (5) room to remove the bottom valve-plate with the valve in the line, and (6) proper location and support to prevent excessive induced stress on the valve-body.

Some of the advantages and disadvantages of different control-valve arrangements are shown in Fig. 1. Control valves regulating flow are actuated by either an indicating or recording flow-controller. No mainline pipe connections are required except the orifice-taps. Pressure-regulators ordinarily have a "tailback" to the vessel at the origin of the line in which the motor-valve is situated. Only if the distance to the vessel is entirely too great, should a tailback into the line itself be considered. Pump-governors are a special case of a pressure-regulator. The control valve is situated in the steam line to the pump and a pressure tailback is required to the discharge line from the pump.

Ordinarily only one valve and one union should be used in a tailback line. The valve is situated at the point of take-off from the vessel or main line. If the tailback is exceptionally long, 50 ft or more, a second valve should be located near the diaphragm connection. Needle-type valves should be used on tailback lines in pulsating service.

Orifice Flanges

Orifice plates are used in the gasoline plant for measuring flow. If the flow measurement is used primarily for flow control, accuracy is not as important as it is if plant throughput or product sales are involved. In either case, we are interested in consistent results. Experience has shown that best results are obtained when the orifice-taps are vertical for gas-flows and horizontal for liquid-flows. Steam-taps may be either vertical or horizontal. When taps are horizontal, particular attention must be paid to the spacing of adjacent lines. The lead-in valves will interfere unless special arrangements are made. The orifice flanges must be located in a section of line where it is possible with reasonable effort to jack the flanges apart ¼-in. to ½-in. to remove the orifice plate. The flanges also must be situated far enough from valves or fittings to insure smooth flow through the orifice-section. Fig. 2 shows commonly accepted minimum straight runs of pipe required each side of the orifice plate.

*C. F. Braun Company.

EXCLUSIVE

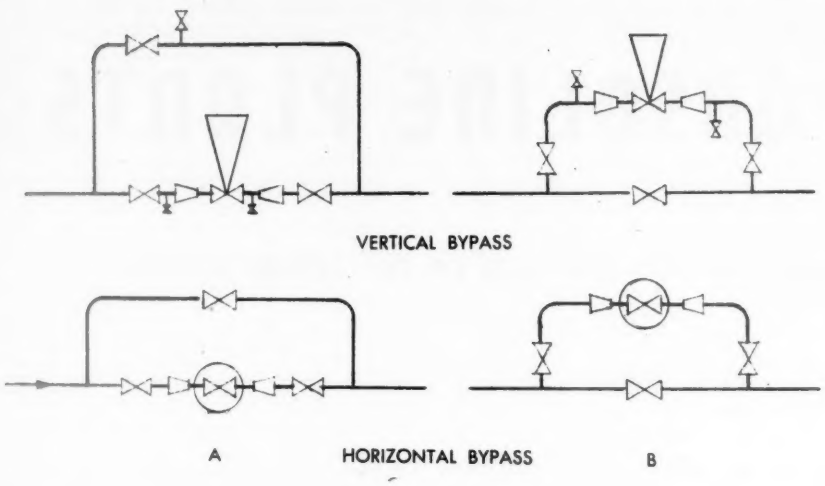
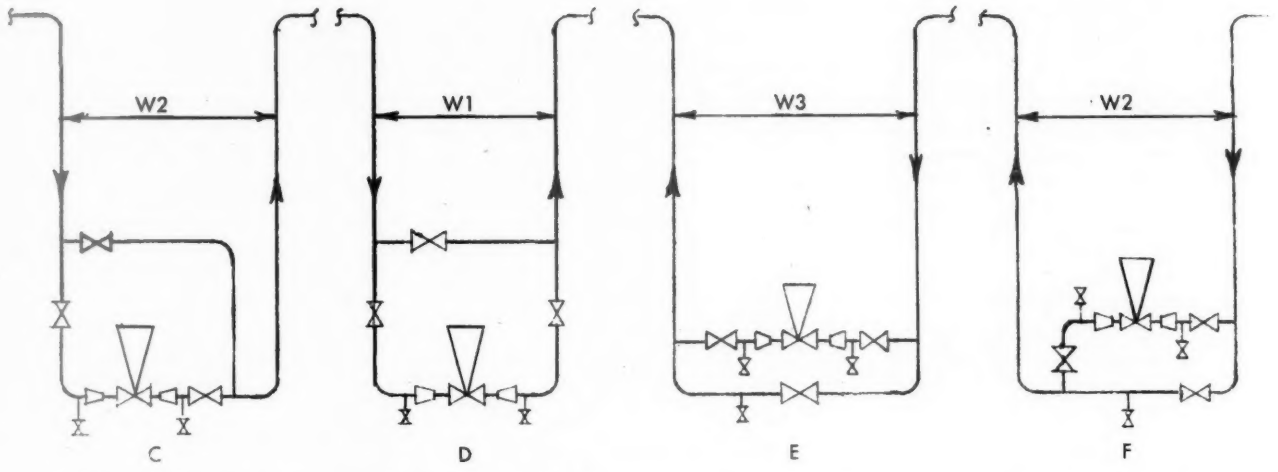


FIG. 1A.—Line stress (A) is concentrated in the reduced section of control valve body. If ring joints are used control valve cannot be removed with the line in operation. In the vertical arrangement the bypass is high due to required clearance over top of control valve. (B) Line stress is not concentrated in control valve. Control valve is easy to remove when necessary. Bypass valve location forms pocket that helps to protect control valve from grit and scale. In vertical arrangement the entire setting is low and convenient for maintenance.



All valves and the control valve are convenient for operation. The control valve is easy to remove.

All valves and the control valve are convenient for operation. The control valve is easy to remove. Minimum width is required for installation.

Setting is compact. The bypass forms a scale pocket. The control valve is very difficult to remove. This setting cannot be used with ring joints.

Setting is compact. Valves are all convenient for operation. The control valve is easy to remove. The bypass forms a scale pocket.

FIG. 1B

Orifice flanges may be situated in either horizontal or vertical lines. The horizontal mounting is normally preferred. If the orifice flanges are mounted in a vertical line, the flow should be downward through the orifice. Most operating companies have found that the degree of accuracy is about the same in either the horizontal or vertical location. The location of the orifice flanges, may be affected by instrument-piping requirements. The meter piping between orifice taps and meter should slope toward the meter at least 1-in. per foot. The total length of meter piping between orifice taps and meter, should not exceed 50 ft. A minimum ½-inch size is commonly specified for instrument piping. The lines should be valved as near as possible to the taps. Preferably the valves screw directly to a nipple with no intervening fittings.

Thermowells

Another small but important item that sometimes gives the piping man a headache, is the location of thermowells. The thermowell may be anything from a piece of ½-in. pipe with one end welded shut in the line, to a scientifically designed, carefully proportioned alloy tube screwed or bolted into the line. The purpose is all the same, to get a temperature measurement of the contents of the line. The same well may be used for either glass-test thermometers or thermocouple connections. A more uniform temperature reading is obtained if the tip of the well extends well beyond the center line of the pipe. In smaller lines, the size of pipe governs the allowable length of the well. If test thermometers are to be used, the outer ends of the thermowells should always face upward. Fig. 3 shows some typical well installations and the maximum allowable well-length for each.

Pressure Gages

There are more ways to install a pressure gage than there are ways to "skin a cat." Fig. 4 shows some of the more common installations. The number and size of fittings used does not involve enough money to be of great importance economically. The number and size of valves required does influence the overall cost of the pressure gage installation. The entire cost of these valves, however, is still such a small proportion of the overall job cost that the economic consideration is over-shadowed almost entirely by the convenience and safety of the gage installation.

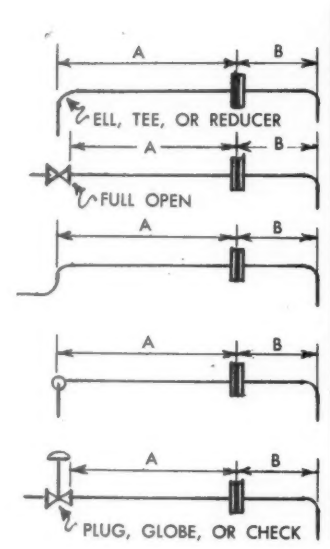
Interruption of plant operation and safety of personnel, are the basis of the decision as to which installation to use. Different evaluation of features involved account for the different arrangements in use. Fig. 4 shows some typical gage hook-ups. Fig. 4A is not satisfactory. A leaky joint or a broken nipple would shut down the plant. The gage could not be removed for adjustment or repair. Fig. 4B overcomes the main objections of Fig. 4A. The movement on the nipple is reduced, however, and two less screwed joints are between the source of pressure and the shut-off valve if the valve is situated in the horizontal at the vessel; see Fig. 4C. The arrangement can be further improved by using a tee and plug instead of an ell, Fig. 4D. With the valve shut off and the plug removed, the connection can be cleaned out should it stop up.

In high-pressure service, even with

the shut-off valve closed, the contents of the line will squirt out when the gage is being removed. After one operator has been burned or had an eye damaged, it becomes much more reasonable to put a valve on the bottom of the tee instead of a plug; see Fig. 4E. Then the pressure can be vented before the gage is removed. Of course, by now a lot of weight is hanging on that ½-in. pipe nipple and with the help of a little vibration, a long-handled wrench or a careless foot there is a good possibility of breaking the nipple between the valve and vessel. For those reasons, it is better practice to use a ¾-in. minimum size out to the first valve. That brings us then to Fig. 4F—the safest reasonable answer to the hookup for a pressure gage in normal gasoline plant service. The union is not required but it does reduce the possibility of damage to the gage or other connections when the assembly must be removed. There are other acceptable variations of this arrangement, using pigtail syphons, diaphragms, sealpots, etc., where special materials are involved.

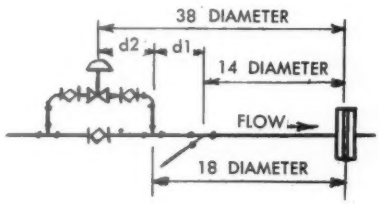
Steam Traps

Steam traps are used to remove condensate from live and exhaust steam lines, steam-separators, or condensing equipment. The inverted bucket-type trap is for use where steam pressure and amount of condensate, are reasonably constant. The "open" bucket, upright type, or the ballfloat type, are generally used where pressure or condensing rate vary through a wide range. The-

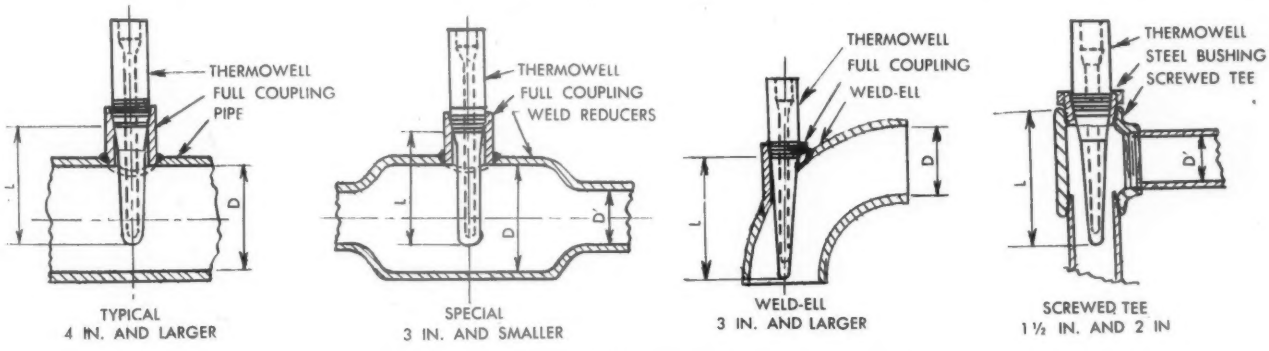


2 IN.		3 IN.		4 IN.		6 IN.		8 IN.		10 IN.	
A	B	A	B	A	B	A	B	A	B	A	B
28	10	42	15	56	20	84	30	112	40	140	50
20	10	30	15	40	20	60	30	80	40	100	50
36	10	54	15	72	20	108	30	144	40	180	50
62	10	93	15	124	20	186	30	248	40	310	50
76	10	114	15	152	20	228	30	304	40	380	50

FIG. 2. Example: If d1 is less than 4 diam, use 18 diam. If d2 is less than 20 diam use 38 diam. Choose condition which will give longest run. If impossible to locate plate to obtain upstream runs as listed in example, straightening vanes may be used.



Note: Above runs are for $\frac{d}{D}$ ratios up to 0.7. Ratios 0.75 multiply run by 1.2. For ratios 0.80 multiply runs by 1.4.



D'	1½	2	3								
D	4	4	4	4	6	8	10	12	14	16	18	20
L	4½	4½	4½	4½	6	8	8	8	12	12	12	12

FIG. 3.

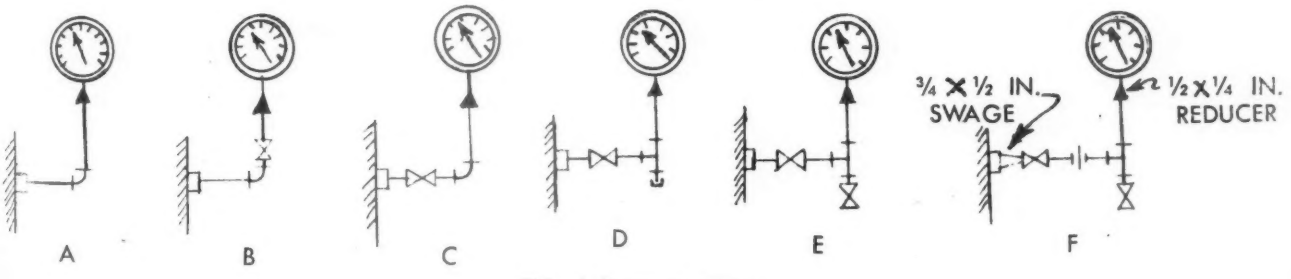


FIG. 4. Pressure gages.

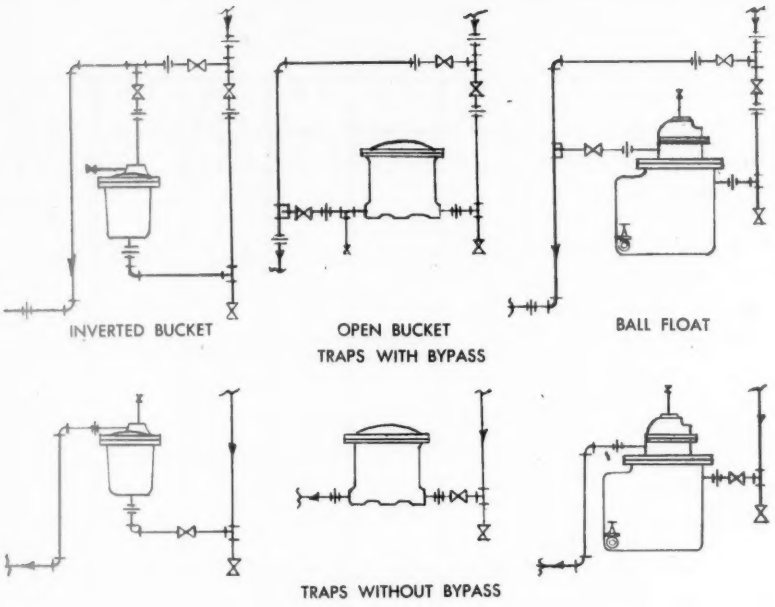


FIG. 5. Steam traps.

piping is different for each type trap. Fig. 5 shows typical hookups for each type trap. Traps connected to process equipment should be bypassed where drainage must be constant, and where the condensate return is to a header system.

The bypass is not necessary if the condensate can be discharged on the ground or to a drain through the blow-off valve. When a trap is bypassed, the bypass should be above the trap. The nipple above the blow-off valve should be 4 to 6 in. in length. This pocket then serves as a scale and dirt trap and protects the steam-trap to some extent. An air-eliminator may be required ahead of the trap. One would only be required in systems where air might be present in sufficient volume to limit seriously the condensate capacity of the steam-trap. Steam traps should be situated at every low point in the header system. It is also desirable to trap extremely long lines at intermediate points, if the loss in elevation is too great due to constant slope, or if the expected condensing rate is excessive.

Fig. 6 is a chart that is helpful in estimating condensate quantities. The size of a steam trap is determined by the maximum quantity of condensate to be handled and the maximum differential pressure. If intermittent operation is to be satisfactory, the trap should be sized for three times the estimated capacity required. Most manufacturers' tabulations represent continuous discharge at the specified conditions. Take-offs to steam-traps are the only utility-lines that come off the bottom of the headers. The take-off line should be valved as near the header as possible. There are two reasons for this valve. If the trap is situated 10 ft or 20 ft from the header, there is always danger of breaking this small line or at least danger of a leaky joint. Then even if the trap is within 3 or 5 ft of the header, that much line would definitely fill with condensate if the trap were shut off. In freezing weather, this again means a broken line. The return line from the trap to the condensate header should go into the top of the header. A check-valve near the header is sometimes a good investment in this line. The check-valve is most beneficial when the pressure differential between the trap inlet and the condensate system is low and when the trap is discharging into an elevated condensate header. The theory is that the check-valve keeps the discharge line from filling with condensate and the trap does not have this additional head of water to discharge against.

The outlet pressure is also reduced by the amount necessary to overcome the inertia of this column of water. When a trap is draining a high-pressure steam system into a low-pressure condensate system, the higher pressure-rated piping material, should be used through the last block valve in front of the inlet to the low-pressure system. Otherwise a safety valve set to the maximum allowable pressure of the piping-material, would be required to protect this portion of the line from overpressure.

Gage Glasses and Level Controls

There is very little actual piping involved in hooking up gage glasses and level controls. The location and hook-

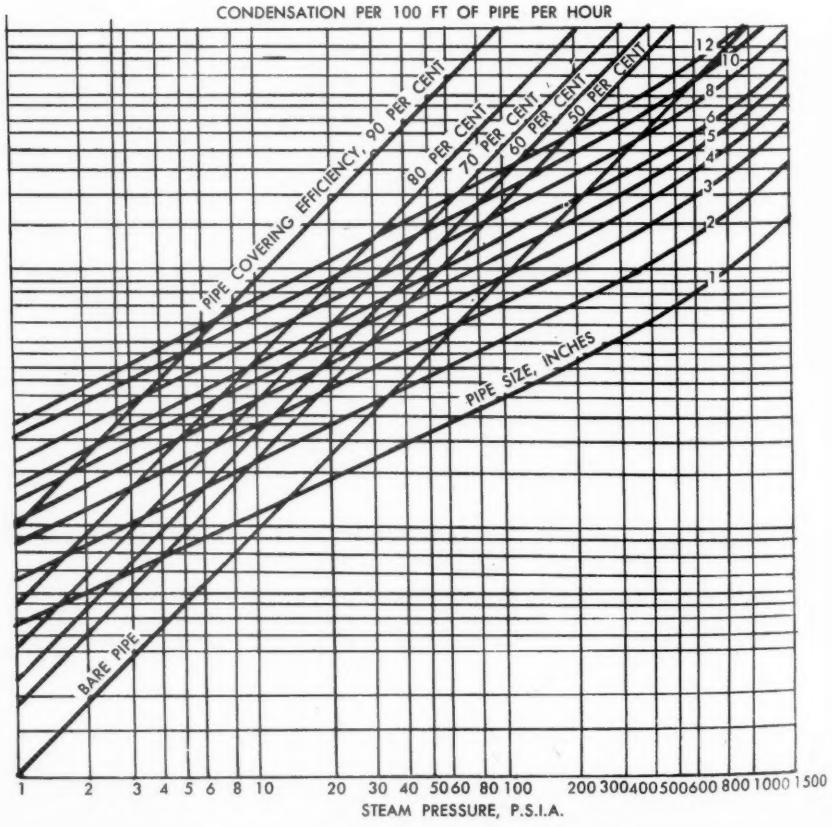


FIG. 6. Condensation from saturated steam lines due to radiation for 70 F room temperature.

Example: Find pounds per hour cond. for 100 ft of 2-in. pipe with steam at 20 lb absolute. Insulation efficiency 90 per cent.

Solution from 20 lb pressure at bottom of chart, proceed vertically to 2-in. pipe size. Proceed horizontally to 90 per cent efficiency line, then vertically to pounds per hour condensation.

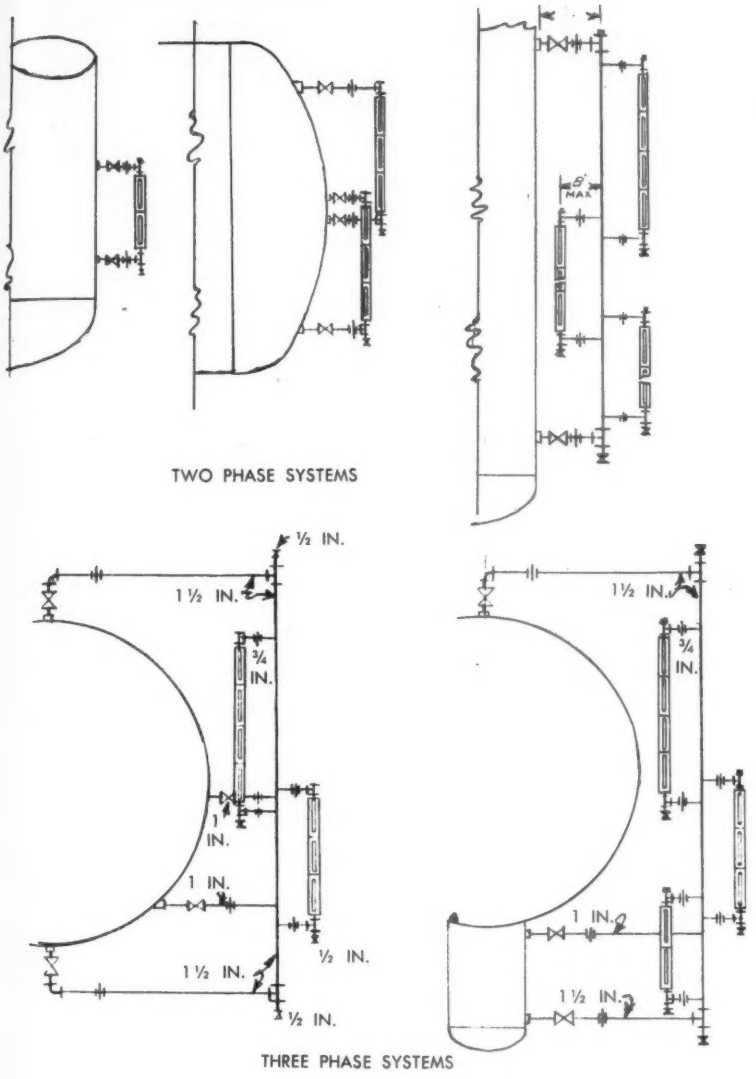


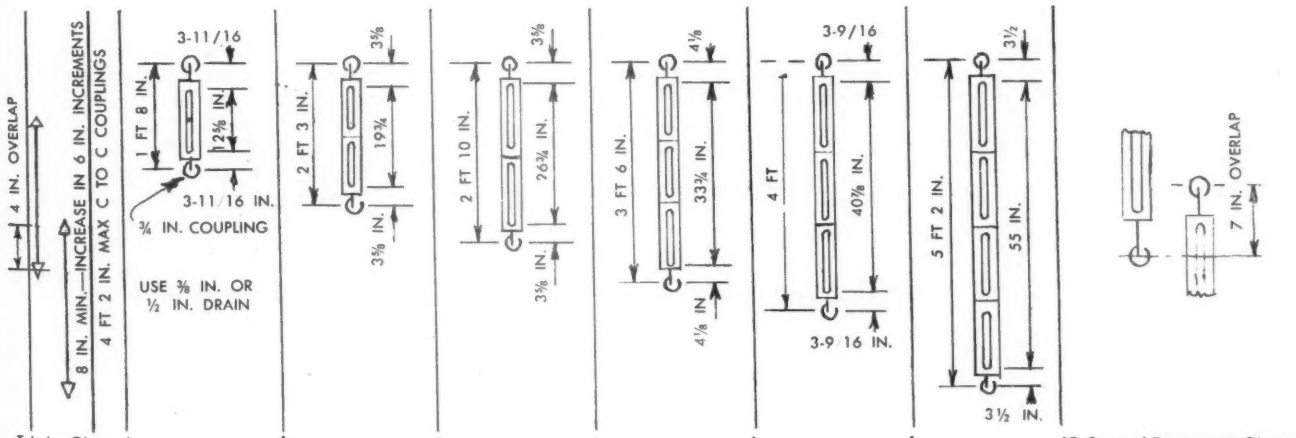
FIG. 7.

up is still usually considered a piping function. The piping is simple, but the location can be troublesome. Gage glasses are used where it is only desired to know the level in a vessel and are used as a check on the operation of a level controller.

Fig. 7 shows typical hookups for two- and three-phase level indication. When it is necessary to cover a long range on a horizontal tank, the use of a pipe-bridle has many advantages. The bridle is an added safety feature and usually aids in getting the glasses situated so that they are more convenient to read and to blow down.

Fig. 8 shows the overlap required for both tubular and reinforced gage glasses. It also shows the centerline distance required between couplings of different size glasses. This chart is an aid to setting coupling location on the vessels before the certified prints of gage-glass equipment are available.

Fig. 9 shows the relative size gage glass required to cover the range of the common size level controllers. The location of the gage glass couplings relative to the level control connection, is also shown. The size of LLC couplings may vary with different types and pressure-classes of equipment. When gage glasses and level controllers are used on the same vessel, they should always be placed adjacent to each other on the operating side of the equipment. At least 6-in. radial distance should be left between the centers of the LLC couplings and the GG couplings. It is good practice to place the gage glass on one side and the LLC on the other side of the ladder serving the vessel. When this is done, both items can be seen from the same point and both can be reached



Tubular Glass Mfg.							Reflex and Transparent Glasses Temp. and Press. Rating	
Penberthy Type	S-1108 V-905 S-T-1208 V-T-1005	S-1125 V-922 S-T-1225 V-T-1022	S-1128 V-925 S-T-1228 V-T-1025	S-1146 V-943 S-T-1246 V-T-1043	S-1148 V-945 S-T-1248 V-T-1045	S-1168 V-965 S-T-1268 V-T-1065	1500*@100° 3000*@100° 1000*@100° 1500*@100°	500*@1000° 1000*@1000° 250*@1000° 400*@1000°
Jerguson Type	19-R-20 19-R-30 19-T-20 19-T-30	26-R-20 26-R-30 26-T-20 26-T-30	29-R-20 29-R-30 29-T-20 29-T-30	37-R-20 37-R-30 37-T-20 37-T-30	39-R-20 39-R-30 39-T-20 39-T-30	49-R-20 49-R-30 49-T-20 49-T-30	1500*@100° 3200*@100° 1000*@100° 2000*@100°	500*@1000° 1200*@1000° 250*@1000° 600*@1000°

S, V & R = Reflex Glass. ST, VT & T = Transparent Glass.

GAGE GLASS DIMENSION CHART

FIG. 8.

conveniently for adjustment. An access ladder or platform must always be provided for serving an elevated level control instrument.

Valves

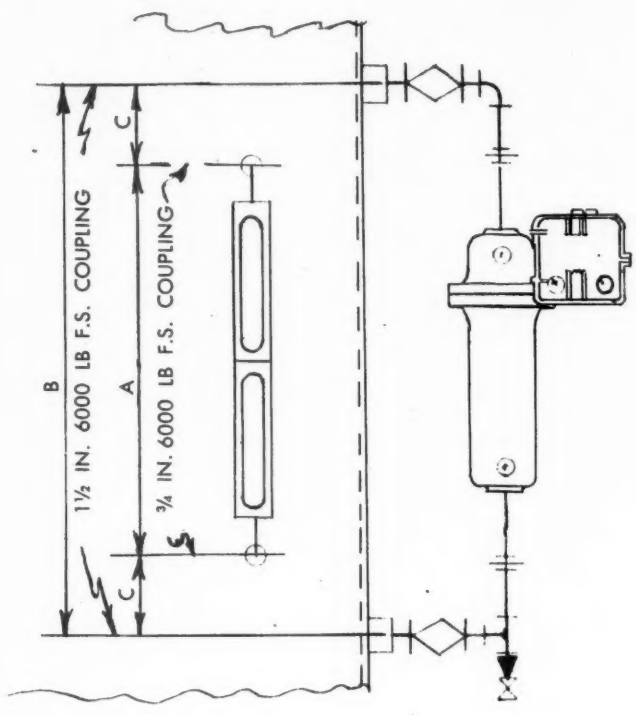
The proper location of valves is just as important as correct specifications of type and material. It is common to specify that each connection below the normal liquid level of a hydrocarbon vessel be provided with a block-valve flanged to the nozzle. This specification is a safety feature in case of a line break. These block-valves on towers are hard to locate where operation is convenient. Normally the nozzles must be oriented and the ladder situated so that the valves are accessible. All block-valves work equally well in either horizontal or vertical lines. No block-valve is designed to be installed with the operating stem down. There is no objection to laying the stem down horizontal and this is often done to facilitate chain wheel or remote operation.

Freezing weather is a consideration in utility valve location. Valves in water and condensate lines, are always susceptible to damage by freezing. Valves in steam, air, and fuelgas lines may be effected. All utility takeoffs should be from the top of the header. And the block-valves should always be located in the horizontal branch as near the header as possible. This location prevents the possibility of water accumulating in the closed valve and breaking the body by freezing. It is preferable too, to locate the shut-off valve in steam lines to steam-drivers in the horizontal. This arrangement makes it possible to drain all accumulated condensate from the line before starting a turbine or pump.

Block-valves are useless unless they can be operated and maintained. Keep safety, freezing, and stress in mind and place the valves where they can be operated if possible from ground or existing platforms. If the valve cannot be reached from existing platforms or ladders, either provide facilities for its operation or do not install the valve. Reasonable access for valve operation varies with the function of the valve. A valve used for throttling or for transfer service must be readily accessible at a convenient location. Valves used infrequently for switching to spare equipment, or changing feed-point are not quite so critical. These valves must be accessible, but other factors may govern to place the valve in a less convenient location. Valves used only once or twice a year, say when an entire plant unit is shut down, are less critical. These valves still must be operated and maintained. The location still should be the most convenient possible in view of other considerations of equal or greater importance involved.

Valve manifolds are sometimes difficult to arrange symmetrically because of interference between adjacent handwheels or operating wrenches. Usually this interference can be avoided by rotating each valve one bolt hole. This rotation will offset the wheels or handles of adjacent valves. Interference is avoided and valve operation is simplified.

In placing and arranging the elements in the piping system, we follow the same general theme established in plant-layout. In order for the overall plant to meet the basic requirements, we must keep these basic requirements in mind in the arrangement and specifications of each element going into the plant. Remember — economy of construction, safety of plant and personnel, ease of operation and maintenance, and a pleasing appearance. * * *



Standard C.I. Extra Heavy C.I. or 600" Steel Disposal Level Connection

DIMENSIONS

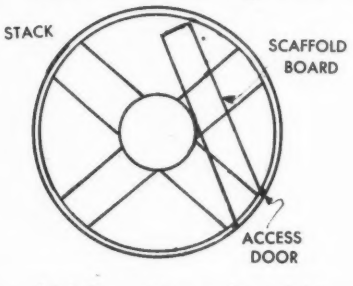
SIZE	A	B	C
14"	2'-10"	4'-0"	7"
32"	4'- 0"	6'-0"	12"
48"	5'- 2"	7'-0"	11"

FIG. 9. Standard connection spacing for level controllers and gage glasses.

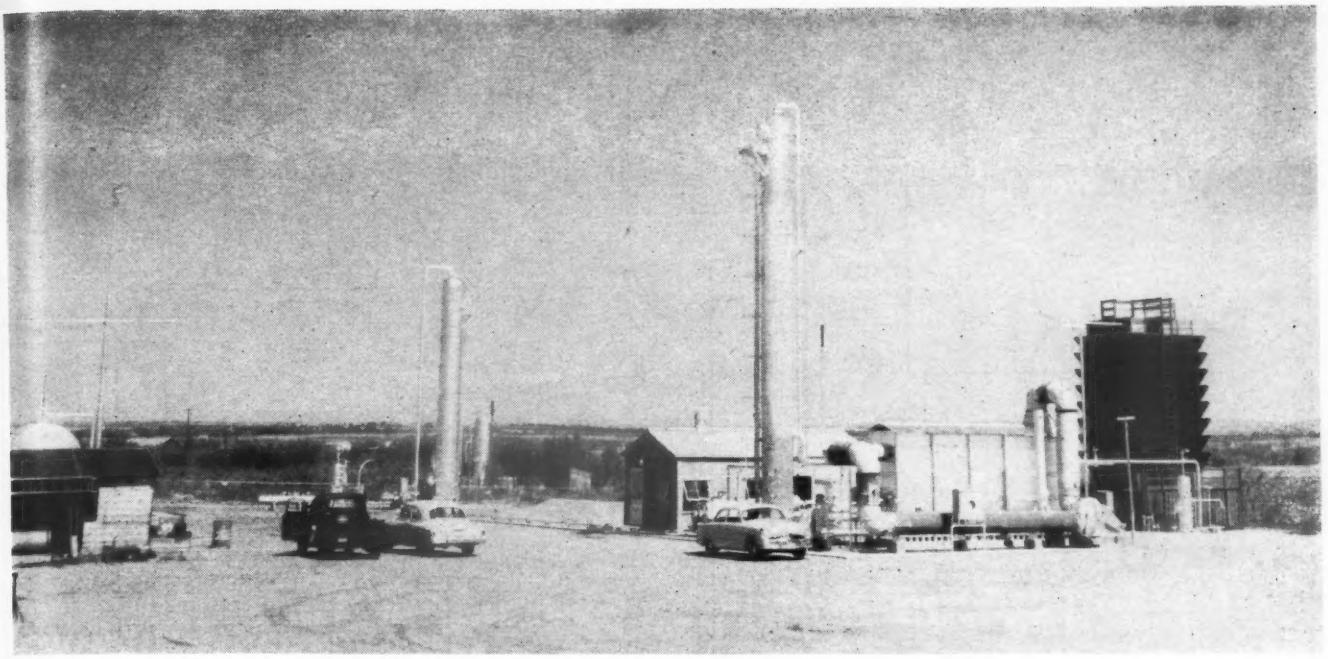
PLANT AID

Inspection Doors and Portable Scaffold in Cooling Tower

Formerly it was necessary to have carpenters build scaffolds on which inspectors and lubrication men could stand while servicing the induced draft fan gears and other items in the top of a water cooling tower. To correct this a door was cut in the draft induction stack, to permit entry without going above this stack. A board was provided in the stack to slide across members on which workmen could stand. Later, permanent walkways were installed from which inspection and servicing can be performed at any time and without interfering with the equipment. * * *



*This plant aid submitted through courtesy of the Humble Oil and Refining Company's Coin-Your-Ideas Plan.



View of sulfur removal unit of Lone Star Gas Company in Bronte field, West Texas. Left background is contactor or hydrogen sulfide absorber; center, regenerator; generator building, left; reboiler, right; water cooling tower, right background.

Desulfurization Makes Line-Gas In West Texas

Diethylene glycol-monoethanolamine-water mixture removes hydrogen sulfide, water, and carbon dioxide from the raw gas

ARCH L. FOSTER*

PURIFICATION of raw, sulfur-containing West Texas gas to make it fit for industrial and domestic use as fuel has been reduced to an exact science in recent years by new methods, reagents, and techniques. Time was, well within the memory of not-yet-middle-aged technologists in the industry, when it was considered uneconomic to sweeten gas by removal of hydrogen sulfide. A strict, arbitrary line of demarcation was established between sweet and sour gas, and the end-use of each was controlled by law. For example one criterion, one division-point between the two classes was 15 grains of sulfur per 100 cu ft, gases containing less than that figure being considered legally "sweet". Those gases containing more than that value were "sour", and could be used for purposes such as making channel-process carbon black. "Sweet" gas, as far as we know, cannot be used for carbon-black production.

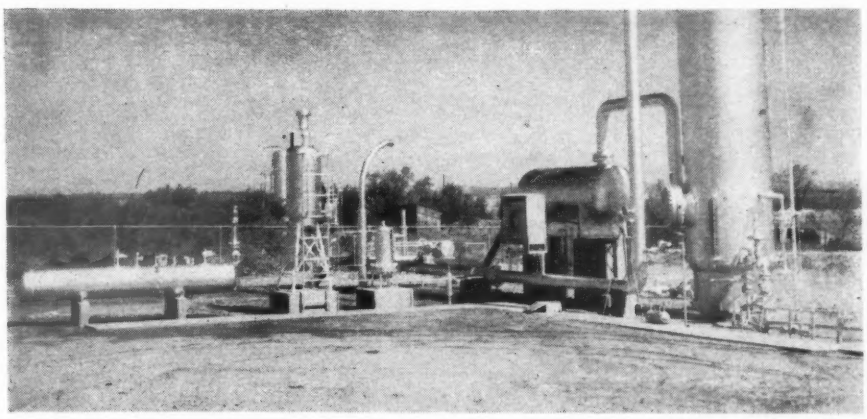
All that custom is being changed rapidly, under the impetus of state and national demand for better utilization of natural gas, the prevention of economic waste, as well as the pressure exerted by greater demands for natural gas as a fuel all over the country. Consequently the process and unit described here may be considered typical of the trend, and qualitatively of the methods and techniques developed to eliminate these undesirable components of natural gas.

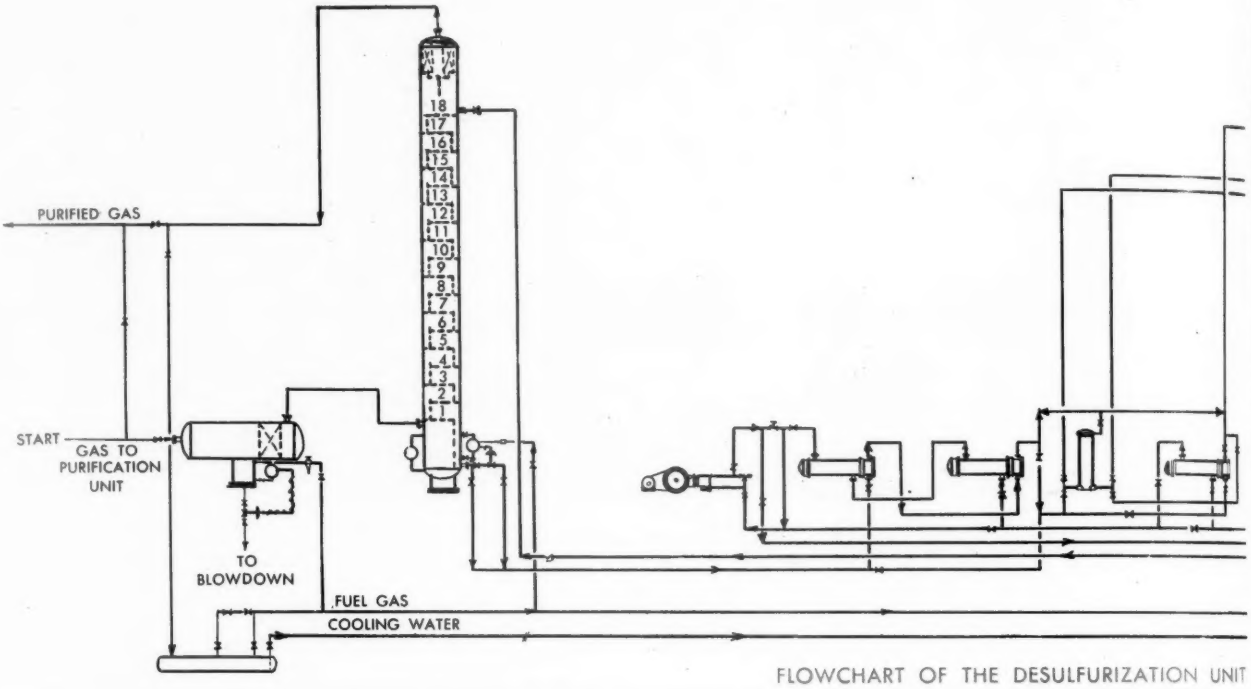
Lone Star Gas Company and affiliated groups, among the largest gas producers in Texas, were faced with large amounts

*Editor, Refining and Gas Processing.

EXCLUSIVE

Base of contactor, with horizontal odorant tank, left, vertical odorant measuring tank, center, small injector odorizer, right center; horizontal scrubber; contactor base.





FLOWCHART OF THE DESULFURIZATION UNIT

of gas that contained too much hydrogen sulfide, carbon dioxide, and water vapor to be acceptable as pipe line gas. Company engineers set about devising means to remove this undesirable material, with research engineer J. L. Thompson as leader in the work. The result has been the design of two units now operating, as described herein.

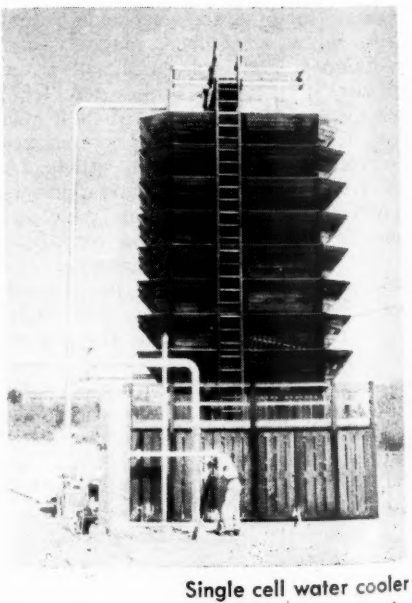
The essential equipment employed in the unit installed at Bronte, Coke County, Texas, for handling 10,000,000 cu ft of sour gas includes:

Underground pipe line drip drum; automatic control mechanism; attendant valves and lines; gas inlet scrubber[1]; odorizer for adding mercaptan to the purified gas[2], and contactor tower. These items constitute the first group in the unit.

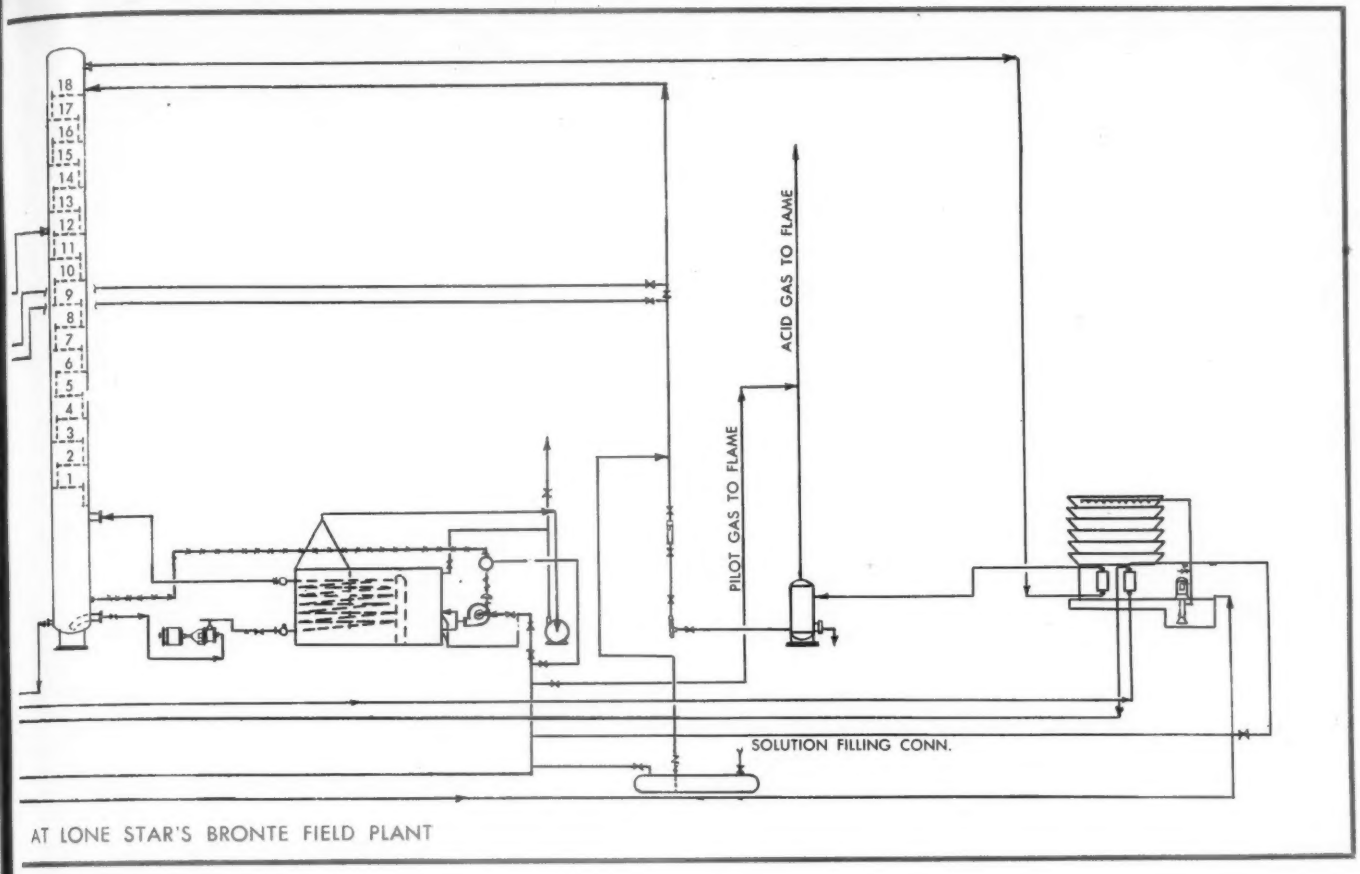
The second main group of equipment includes: regenerator column[1], heat exchangers; regenerator reboiler[1], equipped with special burners[3]; flue gas blower for recirculation[4], and special system for furnace safety protection[5]. A cooling tower[6], has installed in its base a still overhead atmospheric condensing section, cooling the solution between solution pump and contactor tower. Steel tubes are employed in both coolers. A vertical turbine tower pump[2] handles circulation in the tower. A used, riveted construction horizontal tank is receiver for any liquid condensed and collected in the drip drum from the raw incoming gas.

1. Wyatt
2. Peerless.
3. Maxon Premix.
4. Sturtevant.
5. Protectoglo.
6. Hudson.

Raw gas inlet assembly, showing block valve, center back; solenoid valve, lower foreground, recorder, left, and piping to gas inlet scrubber and contactor.



Single cell water cooler serving entire needs.

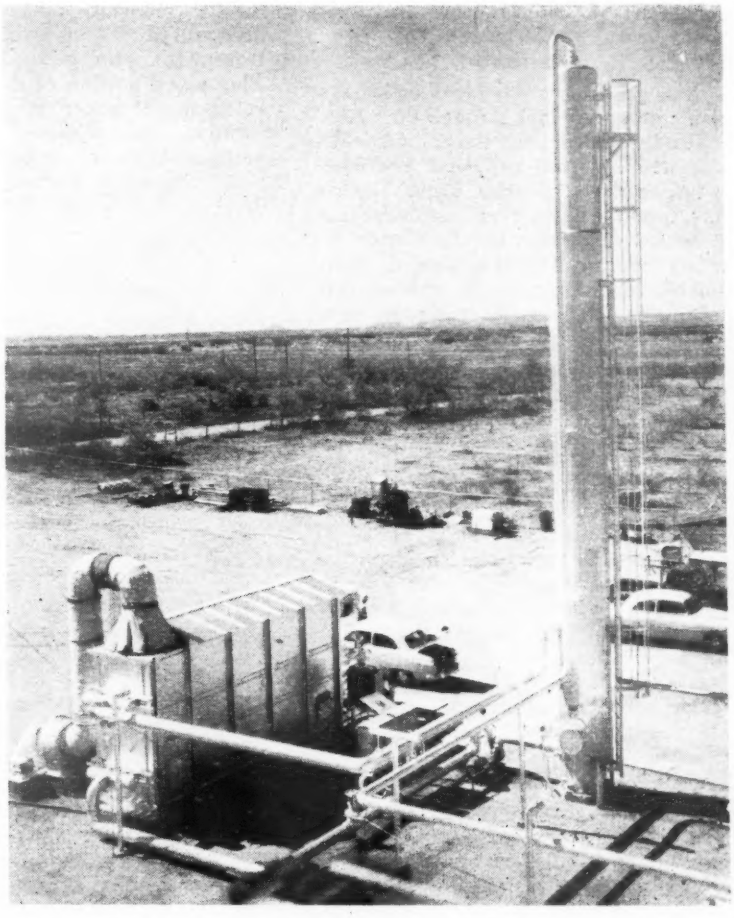


AT LONE STAR'S BRONTE FIELD PLANT

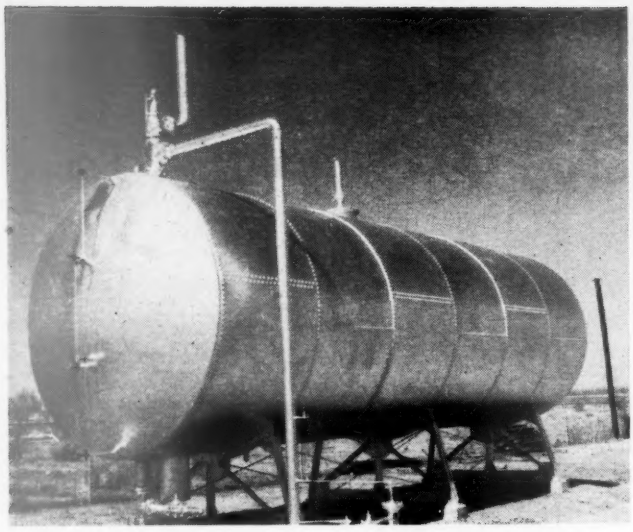
A motor-driven centrifugal pump[7] is installed to handle liquid between reboiler and regenerator column, which is 42 in. by 52 ft, designed for 50 psig and 300 F, and is equipped with a Magnetrol liquid-level control unit. On the exchangers heating foul solution enroute to the regenerator plug valves is used[8]. Gate valves are used in hot serv-

7. Westinghouse, 10-hp, Gould.
8. Nordstrom.

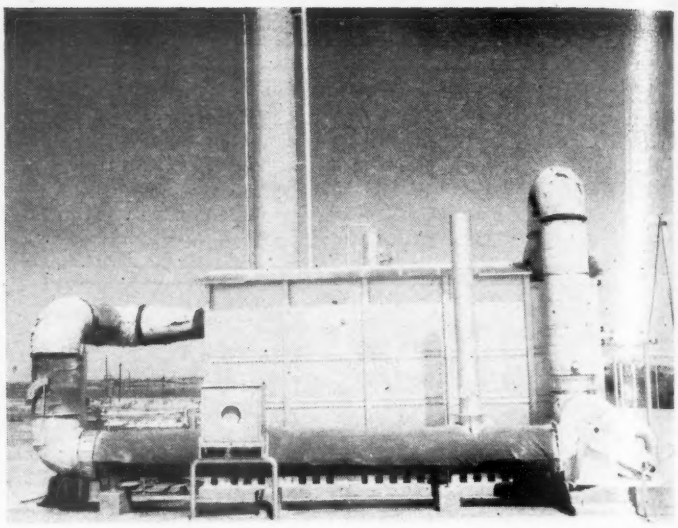
Main regenerator assembly, showing reboiler furnace, recirculation duct and blower, left; furnace feed and return piping, center; regenerator column, right. Upper part of column is uninsulated, to obtain more reflux.



Lone Star staff men confer: A. L. Browning, assistant to foreman; G. M. Hargus, Ballinger district pipe line foreman; and Charles J. Rayfield, technician, natural gasoline operations.



Receiver tank for drip liquid recovered in underground drum on incoming raw gas line.



Solution regenerator, with flue gas recirculation duct encircling furnace and blower at right.

ice—plug valves have been known to stick due to leaching out of lubricant.

Auxiliary equipment used in the plant includes: A 50 kw, E. M. direct-current generator driven by a 4-cycle gas engine[9]; 3-cylinder vertical plunger compressor[10] driven by a 15-hp electric motor[11] through a 10-strand V-belt, and a 5-hp motor-driven[12] water pump.

Among the instruments used are: Protectoglo, already mentioned; Flowrator[13]; panel and switchgear[14]; 2 meter recorders[15], in metal meter houses[2], and one Leveltrol[13] on contactor tower.

Operation

Raw gas from the field collecting system enters the plant through the underground drip drum and the automatically operated, piston-equipped shutdown valve, near the contactor. From this drip any liquid collected passes under gas pressure propulsion to the riveted receiver tank mentioned earlier. A small, solenoid-operated valve in the lower center of this photo controls the pressure to the piston valve, to shut down the gas flow through the contactor in case a malfunctioning of the plant causes the safety circuit, centered in the metal building near the regenerator, to trip the solenoid valve and thus to prevent unpurified sour gas going out through the unit to consumer's lines.

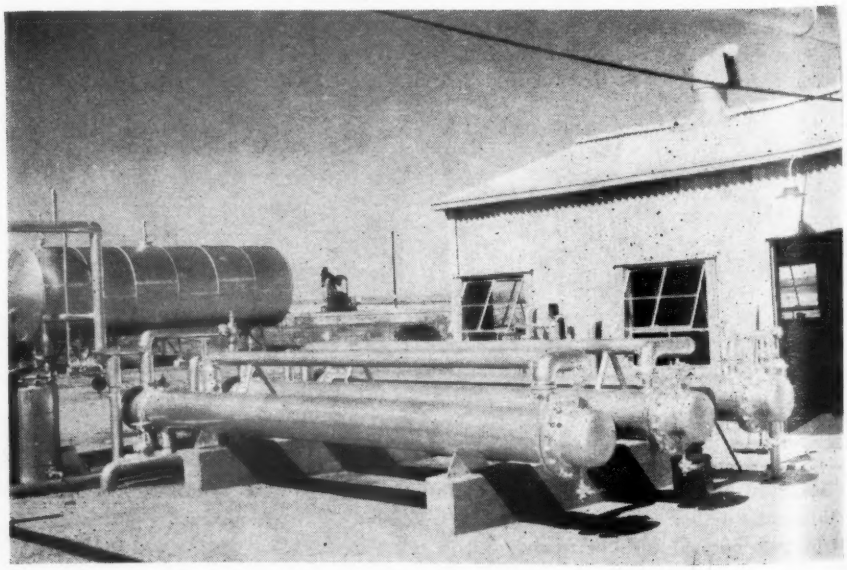
Instrument air is held at about 20 psig. Full line pressure is held on the drip drum, which contains mostly water and some butanes-and-heavier condensate and transferred automatically into the riveted tank.

Gas then enters the horizontal separator drum containing mist extractors, and into the bottom of the contactor, where it meets a regenerated solution of 70 per cent diethylene glycol, 20 per cent monoethanolamine and 10 per cent water, in countercurrent flow. This solution flows at the design rate of 33 gal per minute and the solution in the system amounts to some 1500 gal. Sulfide content of the gas is currently about 40 grains per 100 cu ft, though the unit is designed for 50-grain content. Sulfide is reduced to negligible amounts that cannot be determined by test. Design was also for one mol per cent of carbon dioxide.

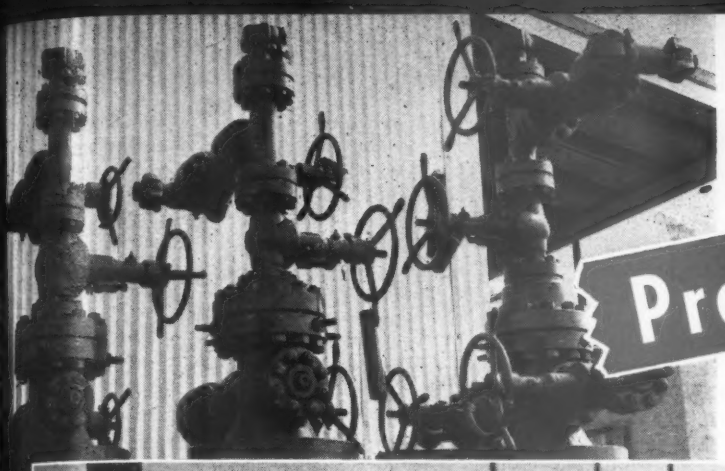
The desulfurized gas from the top of the contactor is metered, odorized, and sent direct to main gas lines for transmission for general consumption. The major portion of this plant is devoted to the regeneration of the foul solution. This solution, goes from the bottom of the contactor to the three heat exchangers, exchanging heat with outflowing reboiled and regenerated solution from the tower. These heat exchangers are in series and after passing through the first two, the foul solution is filtered, the cartridges removing any solids present such as iron sulfide, elementary sulfur, heavy oil, etc., before the solution reaches the column. The solution reaches the column at about 210-225 F, and enters the 18-tray column on the 12th tray. The upper 8 ft or so of this column is uninsulated, to supply more reflux by natural condensation in the upper tower, and the foul solution enters about 4 ft below the top limit of insulation.

Dropping through the tower and into the recirculation pump the solution is reboiled in the furnace type reboiler coils of 3-in. tubes, circulating at the rate of 300 gpm through these coils and coming out at 290 F to be flashed again

In foreground, small vertical rich or "foul" solution filter; left, exchangers handling foul and lean or regenerated solution in heat exchange, center, and generator building, right. Drip liquid receiver and blower at right.



9. Le Roi.
10. Worthington.
11. Louis Allis.
12. U. S. Electric.
13. Fischer-Porter.
14. Nelson Electric.
15. Brown.



Protect Production

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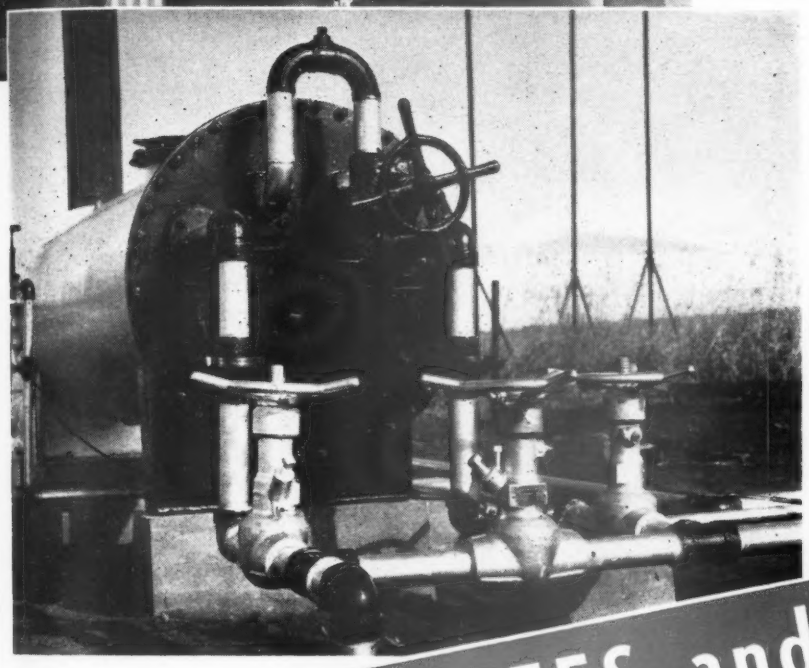

on TREES and MANIFOLDS

Some operators purchase prefabricated Christmas Trees and Manifolds while others choose to assemble these hook-ups on location. In either instance, the operator cannot go wrong in selecting **ORBIT FORGED STEEL VALVES** to protect his investment.

ORBIT FORGED STEEL VALVES are full opening, easy to operate and require a very minimum of maintenance even in the most rugged services; because the mechanism that operates the seating core is completely isolated from the cavity of the valve by a special stem *plastic packing arrangement.* The stem packing can be adjusted or new packing can be added if needed while the valve is in service and under pressure. No lubricant is required to effect a shut-off; however lubrication points are strategically located on the valve body so that the operating mechanism may be only occasionally lubricated to insure the ease of operation **ORBIT FORGED STEEL VALVES** are all so noted for.

Sold by Supply Stores

BRANCHES

HOUSTON, TEXAS
407 Velasco
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(Serving the Rocky Mountain States and Canada)

ORBIT VALVE COMPANY

BOX 699 **TULSA, OKLAHOMA**

in the tower to remove last traces of H_2S and excess water. Water vapor is condensed in coils in the water tower base and is accumulated in the small accumulator for reflux. One-half gallon per minute of this water is returned as reflux to the top of the regenerator tower. The remainder of this water drains continuously back into the cooling basin of the tower. Hydrogen sulfide is withdrawn from the top of this water receiver. The reboiler employs a flue gas recirculation system, in which a blower circulates flue gas to maintain more even temperatures and prevent local overheating and consequently danger of chemical breakdown in the solution.

The sulfide gas, at the rate of about 7900 cu ft per day is burned in a flare, the amounts produced at present making it "uneconomic" to recover the sulfur in elementary form. Although the plant has been operating only a short time, results to date indicate a chemical consumption of about 2 lb of amine per million cubic feet of gas processed. A portion of the lean solution, equal in amount to that being received from the contactor as foul solution, is separated from the reboiler feed and is returned to the contactor system, after exchanging with foul solution as mentioned above. Gas to the amount of 15,000-20,000 cu ft per day must be used to burn the sulfide, as the presence of the indicated volume of CO_2 is enough to prevent the sulfide from burning alone.

Automatic Features

For the present, while the unit is being put on stream and "ironed out", two shifts of one man each operate it. When it is finally perfected in its tune-up, the company expects to require only a few hours per day, for one man, to operate it, the main job being done by automatic methods. The main or central part of the automatic system is a relay panel. Through this panel low voltage (2.5 volts) current is sent to actuate the seven shutdown switches. If through malfunctioning a switch opens anywhere in the plant this break actuates a relay on the panel; this relay opens a high-voltage relay, which closes off the reboiler fuel inlet valve — fuel comes from top of contactor tower—and closes also the automatic piston-operated gas inlet valve admitting raw gas to the plant. At the same time a signal is flashed to a local telephone switchboard in the village of Bronte, and the operator notifies company personnel of the stoppage. This last is done, of course, when no operator is on duty at the plant.

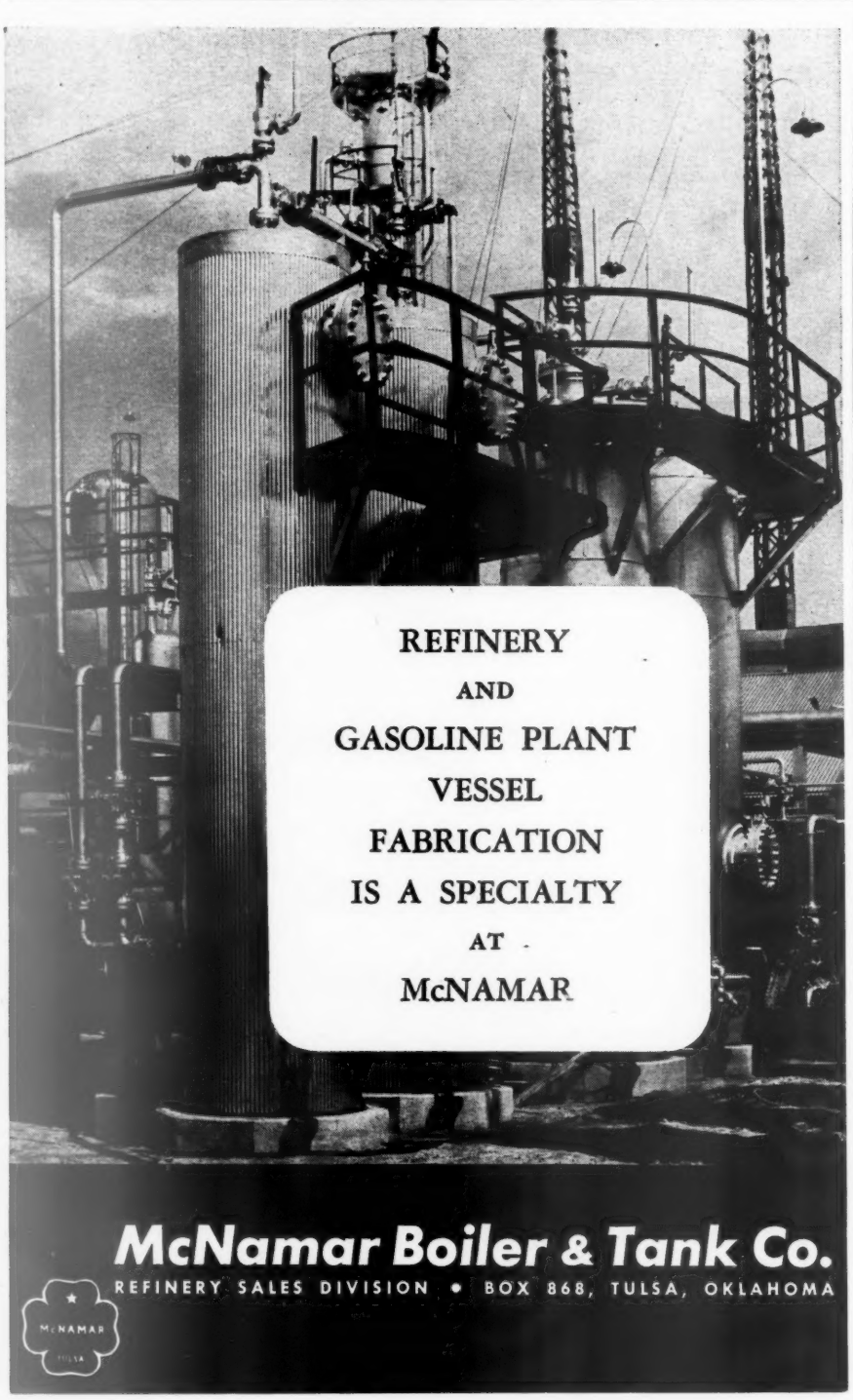
The seven switches are: One low level, on still; one high temperature on reboiler; one low temperature on reboiler; one solution flow on reboiler; one pressure switch on air blower to reboiler; one high temperature on lean solution to contactor, and one flow switch on lean solution to contactor. Any one of these switches can completely shut down the entire plant.

The reboiler flue gas recirculation system is actuated by a blower as noted above, which takes hot flue gas out above the coils, sends it around to the back of and into the top of the combustion section and over the bridge wall which reaches to within 18 in. of the furnace roof. This plant was designed and built in collaboration with Graff Engineering Company of Dallas.

Carbon steel is employed so far throughout the unit, except such small items as trim for motor valves, etc. As heat exchanger bundles are expected to go out eventually, and their life is not known as yet, spare bundles are kept on hand for quick replacement. The regenerator and other fuel requirements, design figures for 10,000,000 cu ft per day, amount to some 78,000 SCD. The plant now is processing only about 1,000,000 cu ft per day, from 3 wells in the Bronte field.

This small amount of gas represents the low summer demand on the field and the unit for gas to meet commercial requirements. Both field and desulfurizing unit are capable of producing the full 10,000,000 cu ft to meet expected winter demands. * * *

Since the outbreak of the Korean fighting, in June 1950, the general cost of living has gone up about 9 per cent; petroleum products, 4 per cent.



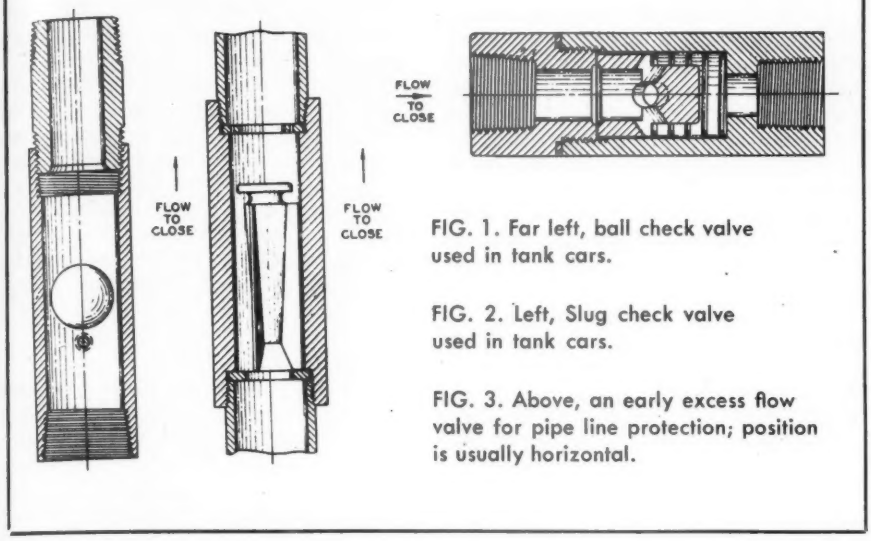


FIG. 1. Far left, ball check valve used in tank cars.

FIG. 2. Left, Slug check valve used in tank cars.

FIG. 3. Above, an early excess flow valve for pipe line protection; position is usually horizontal.

Better Excess Flow Valves for Compressed Gases

Applications for such valves are increasing in number; new designs are more flexible, safer

DOYLE D. BUTTOLPH and HARRY R. ZEIGLER

Excess flow valves promote safety in propane or butane storage and piping systems. These valves, sensitive to excessive flow, close when a hose or pipe line break vents to the atmosphere. Except for a 2-way acting excess flow valve used occasionally in very long pipe lines, excess flow valves are made so they will not prevent reverse flow.

Pipe line breaks can be caused by mechanical strains due to change in temperature or any other natural cause that directly or indirectly affect the pipes or tanks to which pipes are attached. Also some breaks have been caused by trucks or fire. There is always the possibility that tank cars or vehicles may be moved before the transfer hoses are disconnected.

Thousands of tank cars, storage tanks, tank trucks, and small containers are equipped with these safety devices. A smaller number are used in pipe lines. Pipe line style excess flow valves are also used in LP-Gas truck piping, usually on the pump discharge line near where the delivery hose is attached. Greatest use is in liquid service but excess flow valves are also needed and used in vapor service. Direction of flow may be upward, downward, or horizontal.

Earliest excess flow valves were installed in tank cars handling chlorine. Later on they were used in tank cars transporting liquefied petroleum gases. They were placed just inside the manhole cover on liquid eduction lines that extend to the bottom of the tank and on vapor education lines which are above the liquid level. Excess flow valves in tank cars are of two types, ball checks and slug checks. Both depend on gravity to maintain the valve normally open until the flow reaches a certain rate. These valves have undergone very little change through the many years they have been in service. Typical valves are shown in Figs. 1 and 2.

Very early liquefied petroleum gas storage tanks were installed without excess flow valves. When the desirability of such protection became apparent it was natural to try to adapt gravity type valves. To install them, tanks were emptied of liquid and vapor. Manhole covers were removed. Using a modified return bend construction, valves were installed at the bottom outlets. Working inside the tank made this installation a major revision. The reason for doing it this way was that the gravity check would only function when flow through it was upward. Once installed, the valve was inaccessible for repair or replacement except by the slow and costly process of emptying and purging the tank. Due to these nuisance considerations it was a big step forward when valves were developed that could be applied externally.

Tank car type excess flow valves were also used in delivery truck piping. In those days of comparatively low transfer rates it was possible to use a specially designed valve, copied after the tank car slug check but much smaller and equipped with a strong compression spring to keep it open. Fortunately the pumping rate was low and the pump used could develop the discharge pressure needed to overcome the high resistance of this slug check valve.

When tank car slug check valves were being adapted to bottom outlets a new valve shown in Fig. 3 was designed. This was used in vapor, air, and filling lines that connected along the top of the same storage tanks. These valves had slugs of different shape, very light in weight, held open by compression springs. This design was so successful that, with some change it is a popular valve today. As will be seen in Fig. 3 the fluid flow is through holes drilled in the slug.

Improvements required to make ex-

The Authors

H. R. Zeigler

D. D. Buttolph

Harry R. Zeigler is a staff engineer in the design division of the engineering department at Phillips Petroleum Company. For more than 25 years, he has been occupied with the engineering aspects of LP-Gas facilities. Zeigler is a graduate of Cooper Union, New York City with a degree in civil engineering. After early engineering for eastern railroads, Zeigler joined Phillips to concern himself with safe storage and handling of lighter hydrocarbons. Zeigler has written papers on such subjects as "Design of Piers for Horizontal Propane Tanks."

Doyle D. Buttolph manages the instrument and equipment branch of the chemical engineering division of Phillips Research and Development Department. He joined Phillips in 1940 with a BS degree in mechanical engineering. After four years in the army, Buttolph rejoined Phillips as assistant manager of the branch he now heads. He has written and delivered papers on pumps and containers for liquefied petroleum gases. He is a member of the Society of Automotive Engineers.

cess flow valves more useful included making them suitable for closing with any direction of flow, and a change in body style so that they could be inserted into tanks from outside. One valve, Fig. 4, meeting these conditions was designed to screw into a welding flange and piping was attached to the tank by means of companion flange bolted to the welding flange. Another valve, Fig. 5, screwed into a welded coupling and threads were provided at the outlet end of the valve for the attachment of the pipe. Both are held open by compression springs. Balls and slugs were replaced by stemguided discs to increase the flow area and reduce the pressure drop.

Valves inserted from the outside readily protect tanks without manholes. Therefore, this phase of excess flow valve development has resulted in a considerable advantage in cost and weight of tanks. The weight advantage amounting to several hundred pounds per tank is especially important in the case of truck tanks. Cost advantage includes reduction of material, cutting, welding, and machining.

The valve shown in Fig 4 was originally made without the ring of holes through the side wall. Drilling these holes greatly increased valve capacity. Such valves must be installed to give the liquid full access around the body to take full advantage of the flow-way these holes provide. For this reason similar valves were built with much longer bodies. Diameter and location of these holes is fairly critical to obtain best results.

Various makes and models of excess flow valves tended to stick in the open position, one exception being the ball type valve. It can be seen in Figs. 2 and 3, slug checks, and 4 and 5 stem guided valves, that there is a possibility of dirt or gummy substances interfering. As an excess flow valve, like a fire extinguisher, should be ready to operate perfectly when needed in spite of long periods of disuse, Phillips excess flow valves of today are constructed with loosely guided stems to make sure that nothing will prevent them from operating properly. The discs are self centering to compensate for the loose guides.

We have all learned, sometimes the hard way, that to transfer volatile liquids, such as propane, satisfactorily, restrictions caused by valves, fittings, pipe, and so forth must be kept to a

FIG. 4. An early bottom outlet valve which can be installed from outside the tank.

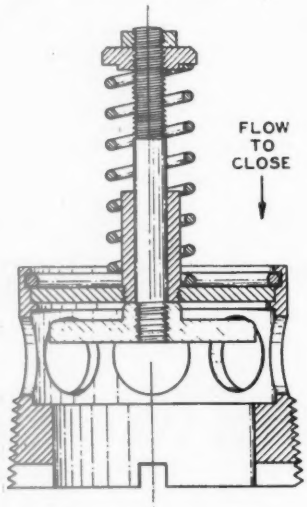


FIG. 5. Another bottom outlet valve which can be installed from outside the tank. It can also be used in pipe lines.

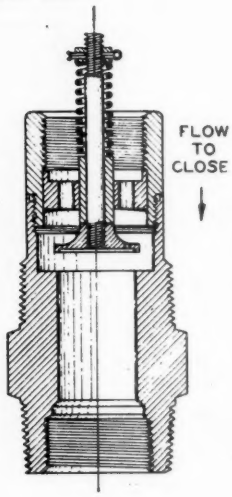


FIG. 6. Type 1511A excess flow valve drains tank to low level.

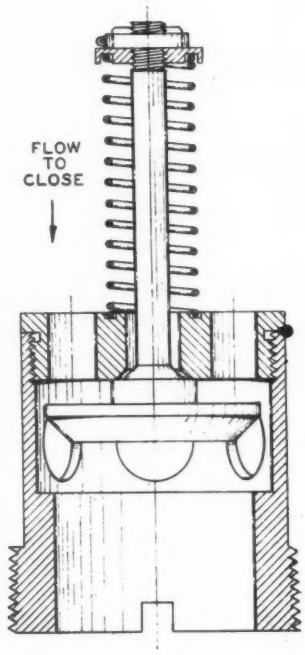


FIG. 7. Type 3500A prevents trouble from rust and mill scale.

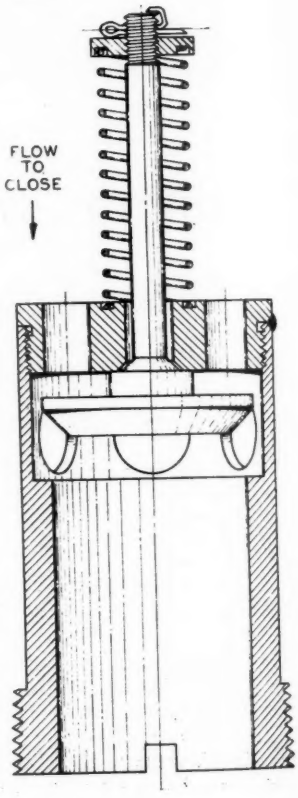


FIG. 8. 1519-C excess flow valve for top outlets with or without eduction pipe.

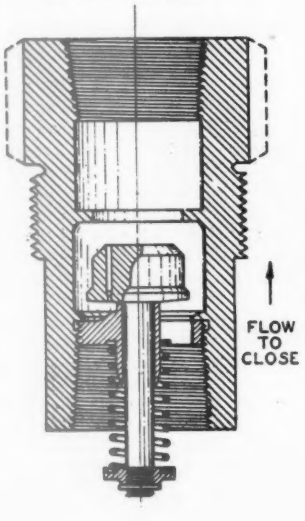


FIG. 9. 1519A-2 pipe line valve.

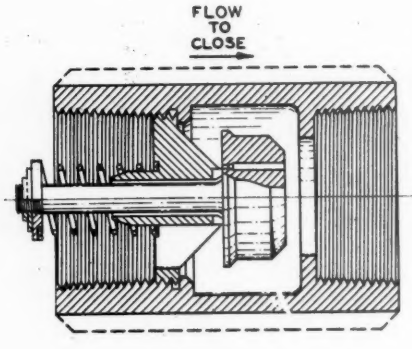
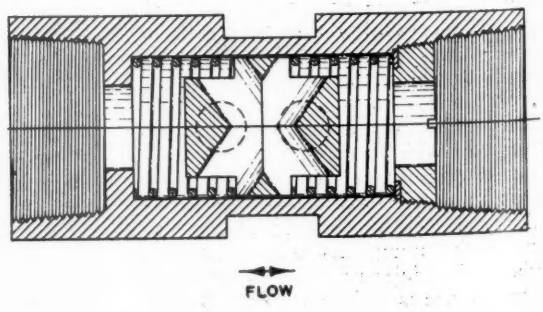
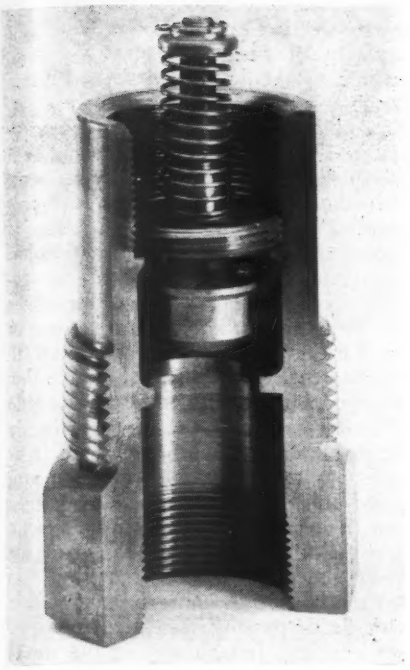


FIG. 10. Double acting excess flow valve.





Cutaway view of 1½ in.-1519 C excess flow valve for top outlets of storage tanks. (See Fig. 8). It can be used with eduction tubes for liquid withdrawal and has rated flow capacity of 3600 gal propane per hour. Used without eduction tube for vapor withdrawal the rated capacity is 14,350 cu ft propane per hour.

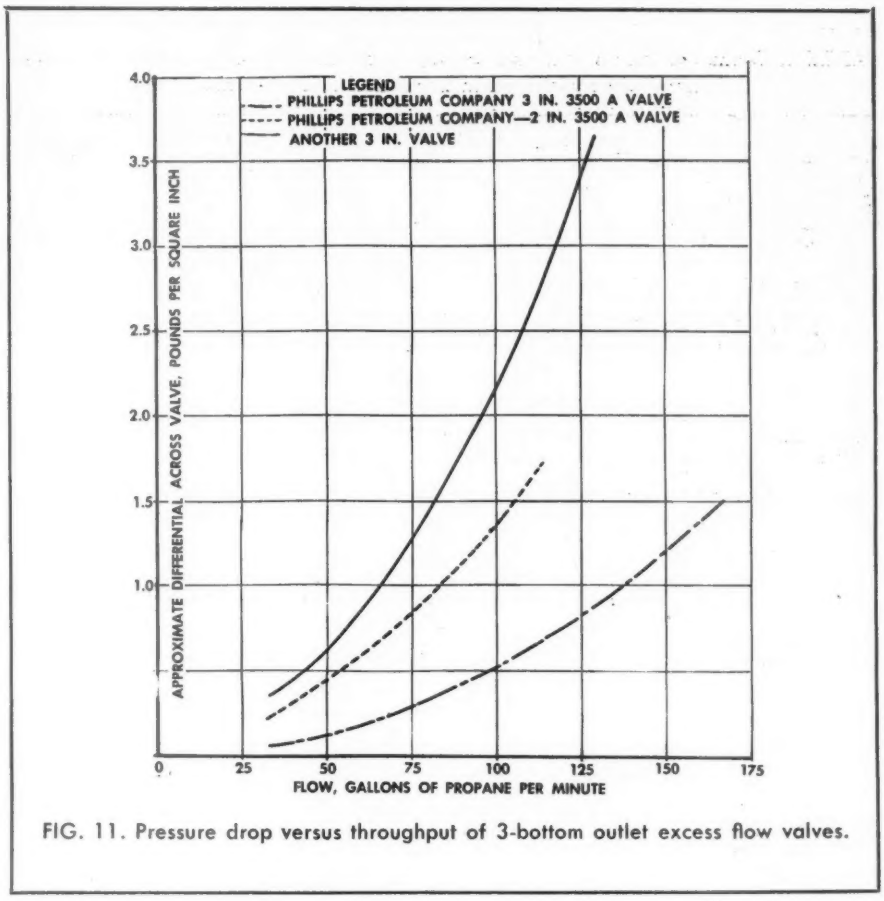
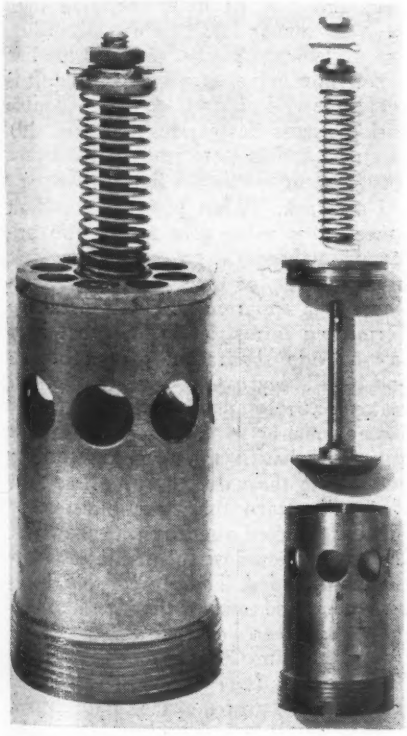


FIG. 11. Pressure drop versus throughput of 3-bottom outlet excess flow valves.



Left, assembled view of 2 in.—3500A bottom outlet excess flow valve. Made in 3 ratings; 4300, 5300, and 6800 gal propane per hour. Also made in 3-in. size with ratings of 7000, 8400, and 10,000 gal propane per hour. Right, exploded view of 2-in.-3500A excess flow valve showing body, disc and stem, guide, spring and fastenings.

minimum. At first thought, to obtain a low pressure drop, it seems practical to use an oversize excess flow valve and reduce to the desired pipe size at the outlet end of the valve, but there are several objections to this. The larger valve would cost more for material and maufacture, reducing fittings would complicate the piping, and if installed in a tank the tank opening would be larger. A more important consideration is the attitude of the LP-Gas industry expressed in NFPA Pamphlet 58 (NBFU Pamphlet 58) paragraph B.6 (c) as follows: "The connections or line including valves, fittings, etc., being protected by an excess flow valve shall have a greater capacity than the rated flow of the excess flow valve." The industry has interpreted this to mean that the thread size of the pipe connected to the valve outlet should not be smaller than the thread size of the valve itself. As it is economically undesirable to use oversize pipe it is easy to see why excess flow valves should be constantly improved by increasing the flow capacity compared to the pressure drop.

There is a great difference in excess flow valves today as illustrated in the performance curves, Fig. 11, of a Phillips 3-in. number 3500 A compared with another popular 3-in. valve. Perhaps this difference is emphasized by the performance curve of a 2-in. 3500 A valve on the same figure. These valves are "Underwriters' Approved."

A recent accomplishment in excess flow valve evolution is the non-chatter excess flow valve known as the Phillips 1519C. It was found that excess flow valves in pipe lines and in eduction pipes of tanks would chatter under certain flow conditions due to liquid "hammer" effect. This chattering or hammering in undesirable and sometimes intolerable because of the noise, because of the damage often inflicted on the valve and also because of the temporary disruption of operations. Another objection to a valve that is subject to chattering is that it will often fail to stay closed in an emergency, especially at low pressure. It was necessary to carry on extensive flow tests in order to diagnose the cause of chattering and to devise a cure. As a result of much experimental work, a throttling type disk was developed that would close without chattering at unusually low upstream pressure; in most cases, the upstream or tank pressure could be as low as 10 psig. The 1519C non-chatter valve illustrated in Fig. 8 is manufactured for use in tanks for the protection of top outlets and it can also be used in end outlets and bottom outlets. The same principle is used in an excess flow valve of the pipe line style, known as Phillips 1519A2 (See Fig. 9.) In many localities all valves that are attached directly to liquefied petroleum gas storage tanks must be approved by Underwriters' Laboratories, Inc., if such approved valves are obtainable. Phillips excess flow valves for storage tanks are Underwriters' Laboratories, Inc., approved.

Several considerations are necessary

TABLE 1. Estimated length of liquid propane pipe line protected by Phillips excess flow valves mounted in horizontal storage tanks.

Valve number	1519 C (1) (2) 1519 A-2 (2)		1519 C (1) (2) 1519 A-2 (2)		1519 A-2 (2)		1511 A (1) 3500 A (1)		1511 A (1) 3500 A (1)	
Size	1″		1½″		2″		2″		3″	
Closing flow rating (gph)	1300		3500		6000 (4)		6800 (3)		10,000	
Closing differential (inches W.C.)	64		114		103		50		42	
Assumed storage pressure (psig)	10	20	10	20	10	20	10	20	10	20
Straight pipe protected—(feet) (5)	90	275	80	320	120	435	205	455	710	1500

(1) Underwriters Laboratories, Inc. listed for LPG.
(2) Valve equipped with eduction pipe.
(3) 1151 A & 3500 A can be supplied at lower ratings with correspondingly greater pipe length protection.
(4) Can be supplied at higher rating. (Not recommended)
(5) Pipe line is same nominal size as the valve. Deduct from lengths shown to allow for valves and fittings in the line.

Description of valves

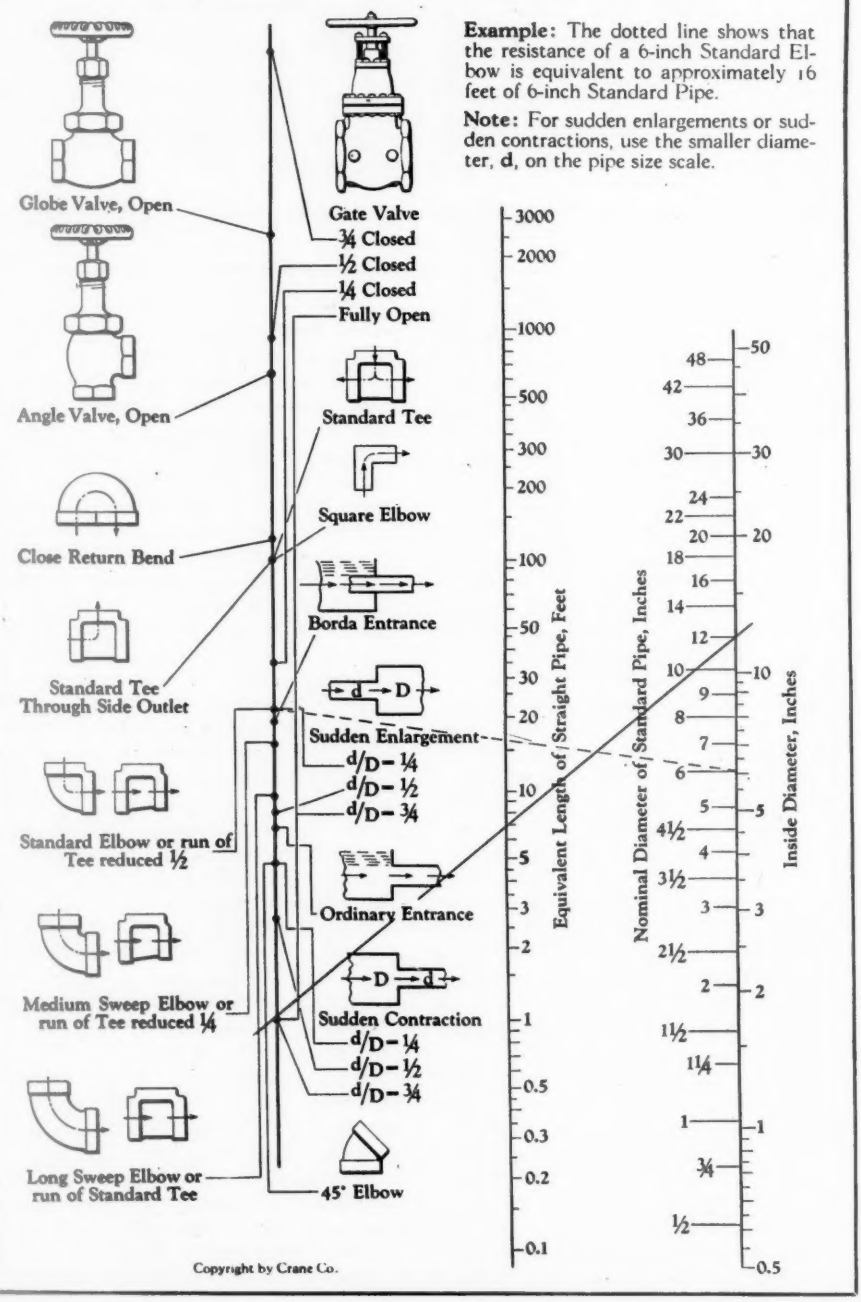
1519 C Has outside thread for insertion in tank outlet. Inside thread at one end for eduction pipe and at other end for pipe line attachment.

1519 A-2 Has inside thread both ends. For pipe line use.

1511 A Short body valve for storage tank bottom outlets. Has outside thread for insertion in flange. Pipe line to be attached with companion flange.

3500 A Similar to 1511 A except has longer body. Will not drain tank as low as the 1511 A but has less trouble from rust and mill scale.

FIG. 12. Resistance of valves and fittings to flow of fluids.



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when selecting excess flow valves. Flow capacity of the valve must be high enough to handle desired normal quantity of fluid but it should close automatically if flow exceeds this quantity materially. Usually the rating should exceed desired flow by 10 to 30 per cent. Direction of flow, (whether upward, downward or horizontal) will influence capacity slightly. Vapor lines and liquid lines should be protected by these devices. Development of excess flow valves has been due to their widespread use in the LP-Gas industry but it is well to mention that they can be of great value to industries handling other combustible or lethal fluids. As they are ordinarily rated in terms of propane flow it is necessary to convert to flow of the proposed fluid. This can be done by taking into account the respective specific gravities of propane and the fluid for which the valves are to be used.

Valve materials must be compatible with fluids passing through them. For propane and butane any of the usual metals are satisfactory and this is also true of dry chlorine. Brass, bronze, and certain stainless steels are unsuited to wet chlorine, however. Carbon steel is suitable for dry ammonia and several grades of stainless steel can be used for wet ammonia. These are examples at random and the valve manufacturer can determine the best metals for other services.

In the case of extensive pipe lines such as exist in large industrial, utility, or bulk storage plants, several pipe line excess flow valves may be required. It is sometimes desirable to use double acting excess flow valves (see Fig. 10) in such pipe lines to prevent back flow escape of liquid due to line breakage.

Users ask, "What protection will an excess flow valve give me?" The primary purpose is to protect against breakage of pipe lines and hose connections. It is apparent that only breakage permitting unrestricted flow, that is to say a wide separation of the broken ends, will cause the valve to close, a matter entirely out of control of the designer or user of the valve. It is also apparent that if the break is too far away from the valve the pipe line friction will retard the liquid flow below this unrestricted quantity with the result that the excess flow valve will not function as intended. Therefore Table 1 has been compiled to show the pipe line protection that can be expected when Phillips Petroleum Company Underwriters' Laboratories, Inc., approved valves are installed in propane tanks and pipe lines. The table is in terms of straight pipe and Fig. 12 can be used to make allowance for valves and fittings in the line.

Excess flow valves should be tested annually to make sure that they will close properly. It is sometimes necessary to part the pipe line downstream from the valve being tested. If this is necessary it should be done at a spot chosen for safety reasons. * * *

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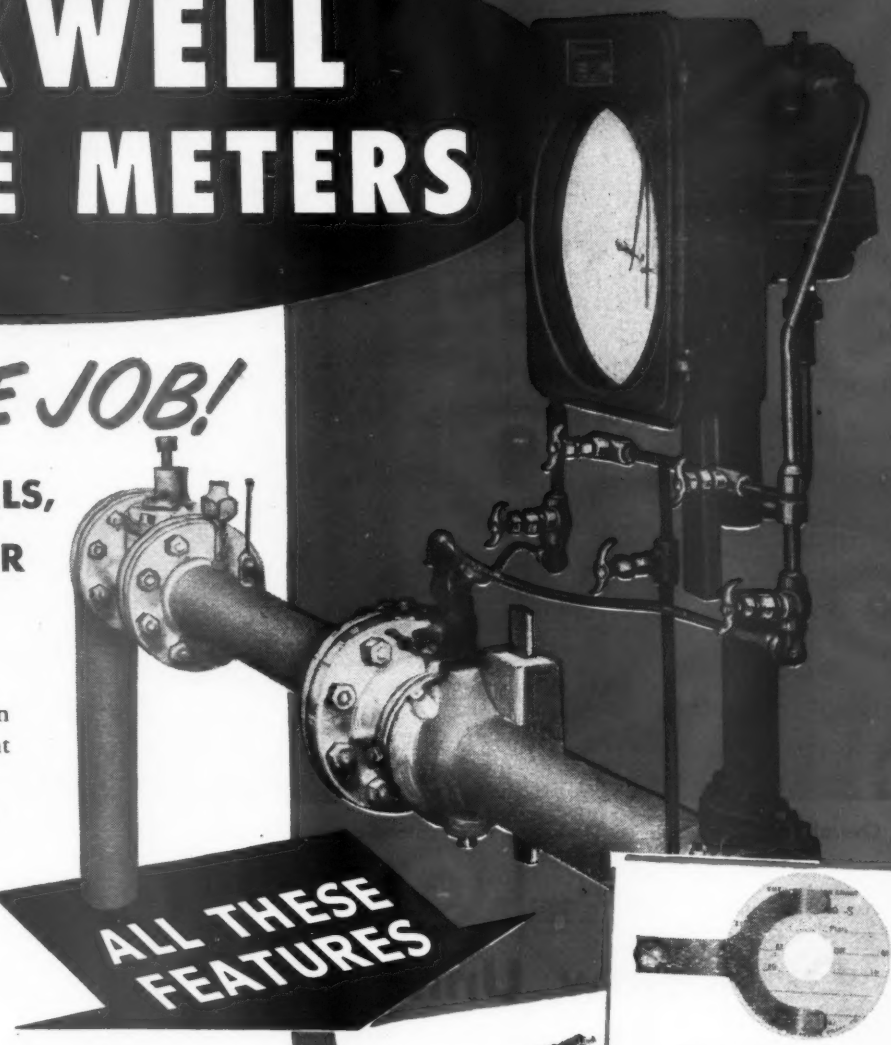

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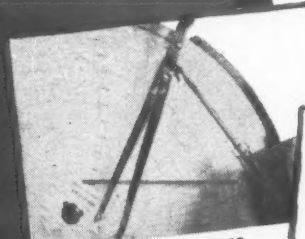

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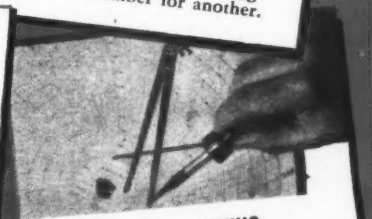


POSITIVE INKING
Chart moves from underside of pen to top. Design prevents blurred or missing records.

Overall view of completed Orthoflow Fluid catalytic cracking unit at Cities Service's Ponca City, Oklahoma refinery.

P 721.34

Orthoflow Unit — New Feature of Refinery

Reactor and regenerator in vertical line and an inside catalyst stripper characterize new cat cracker design

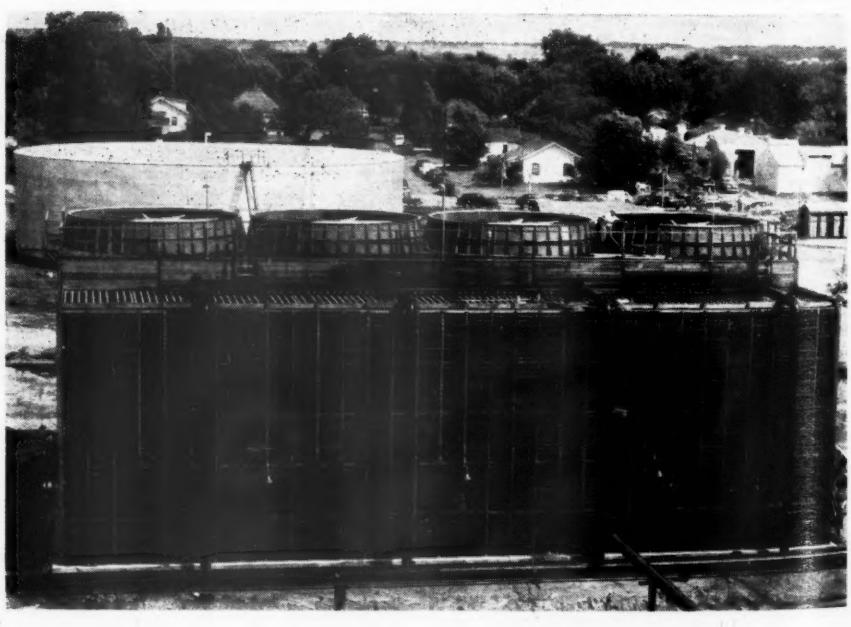
W. T. ZIEGENHAIN

CITIES SERVICE is introducing the principles of "Orthoflow" in the Mid-Continent refining area. Normal operation of its new 8350 bbl per stream day Fluid catalytic cracking unit undergoing its initial run at the company's Ponca City, Oklahoma, refinery calls for processing 30 gravity gas oil cut from West Kansas crudes. Its products include a 340 EP debutanized gasoline, a light naphtha of 325-430 F boiling range, a 29.1 API gas oil, a heavy gas oil of 27 API, a decanted fuel oil of 23 gravity, a liquid propane - butane bottled fuel mixture, and some plant fuel gas.

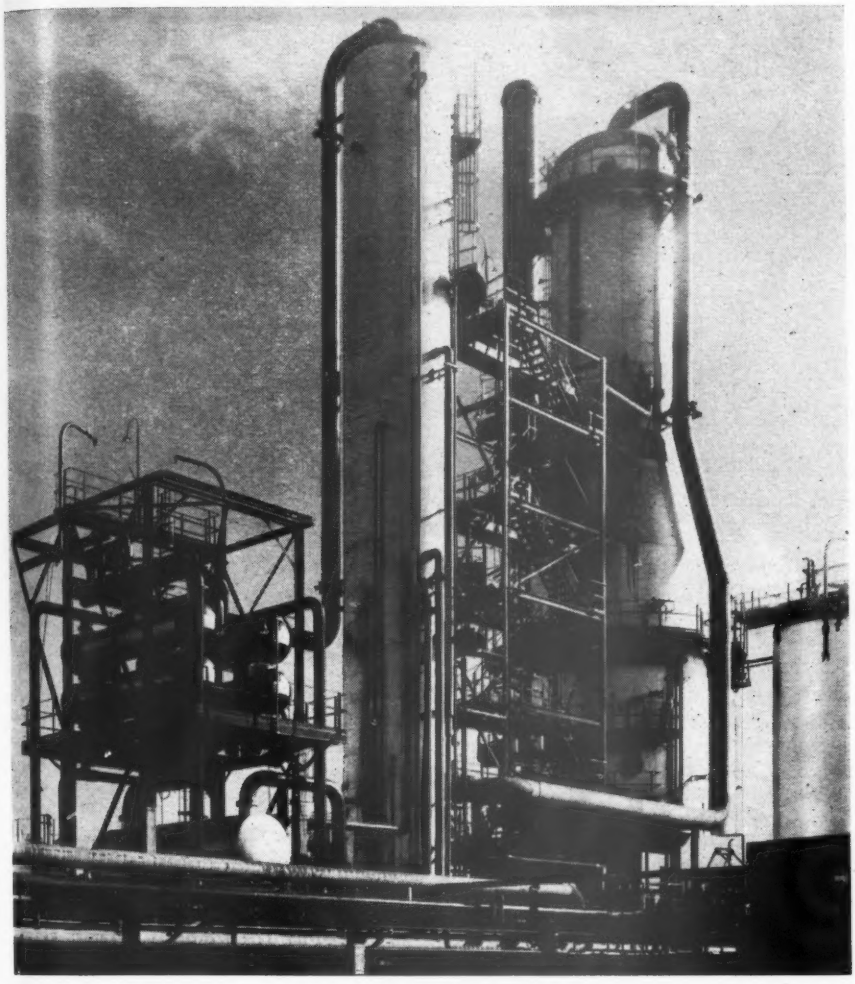
The term "orthoflow" is derived from the straight-line connection between the reactor and the regenerator sections of the orthoflow converter. As the intimacy of contact is most essential, exacting design features characterize the entire unit, but most particularly, its reactor portion. This piece of equipment can

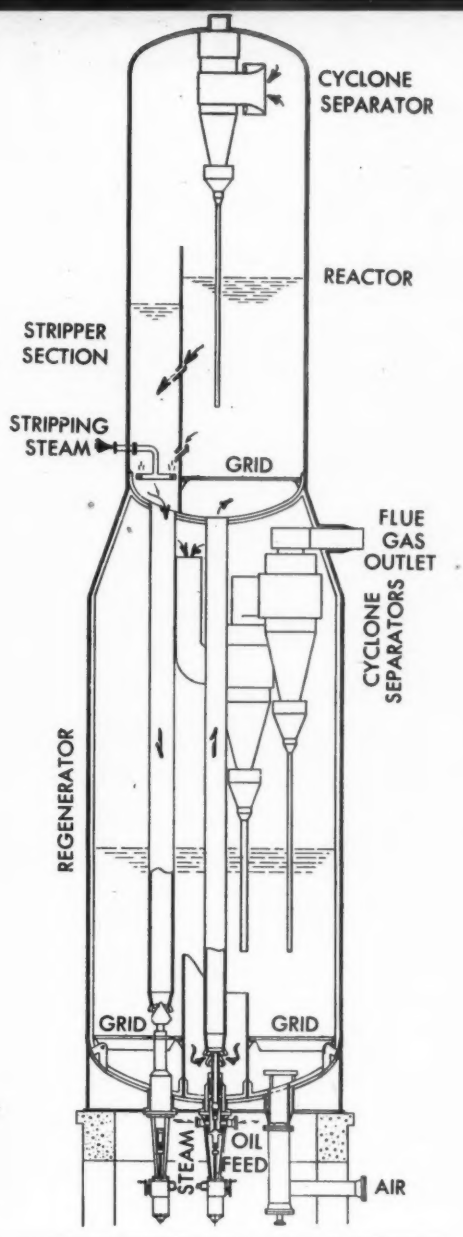
EXCLUSIVE

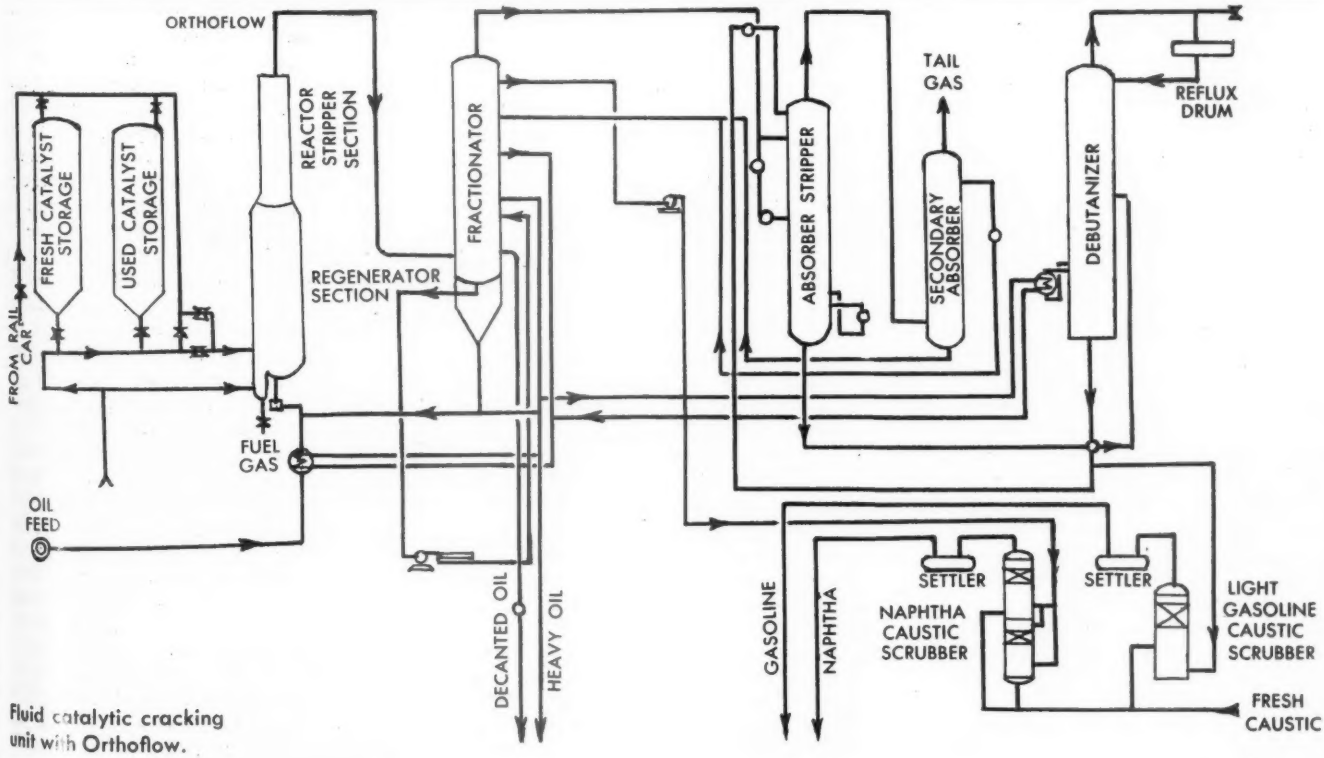
Looking east at new cooling tower.



Below, close-up of Cities Service's Orthoflow unit, showing converter assembly, right; main fractionator tower, center; cracked vapor line connecting the two. Right, diagram of Orthoflow. Upward through the base are three tubular openings. The oil feed and steam enter at the center riser. Spent catalyst controlled valve is to its left; third opening at base is auxiliary air heater.







Fluid catalytic cracking unit with Orthoflow.

Battery of pumps, some steam and some electric-driven, and the systematically arranged overhead piping, serving the new Cities Service Orthoflow unit.

best be visualized when reference is made to the accompanying drawing.

Preliminary Steps

Five major steps in the initial processing of the crude are taken. Crude is stripped of a normal cut of straight-run gasoline, naphtha, kerosine distillate, gas oil "catalytic cracking stock", and "tar". The naphtha is reformed thermally to produce a relatively high octane motor fuel, a C_3-C_4 bottled gas component and plant fuel gas. The residuum or "tar" together with the relatively heavy products of the gas oil catalytic cracking unit pass to a coking operation where the composite produces another stream of cracked gasoline, a C_3-C_4 fraction, gas and "coke". Returning to the gas oil fraction, 8350-9000 bbl are available as an average daily charge to the new unit.

Cat Cracker

Of the 30 gravity charge to the unit, approximately 5 per cent leaves as permanent refinery gases. This gas is essentially methane and ethane. Another 15 per cent is recovered as liquefied gases or is represented chemically as the C_3-C_4 cut. Approximately half the original charge to this "cat-cracker" is represented by the two streams of gasoline, which for plant purposes are designated as "light" and "heavy" gasolines. Light gasoline is a 340 EP product. The heavier stream here termed naphtha has the following distillation characteristics:

IP	325 F
50 per cent	377
90 in.	417
EP	430

As distillate fuel the plant recovers approximately 20 per cent of the original charge as No. 2 fuel. The remaining two products of the operation when combined, represent about 10 per cent by weight of the original charge and it is this material that is pumped with the residue of the original crude to the high pressure coking operations.

Comparatively little outside heat is supplied the oil undergoing actual cracking.

With similar discretion, circulation of the catalyst through the reactor, spent catalyst stripper and the regenerator serves four purposes:

(1) The action of the catalyst upon the oil is necessary to accomplish cracking.

(2) The hot regenerated catalyst is used to supply heat to the reaction zone. The heat transferred from the catalyst to the oil is sufficient to completely vaporize the oil, to bring it to cracking conditions and to supply the heat of (endothermic reaction).

(3) The coke produced by cracking is deposited upon the catalyst and is carried from the reaction zone to the regeneration zone.

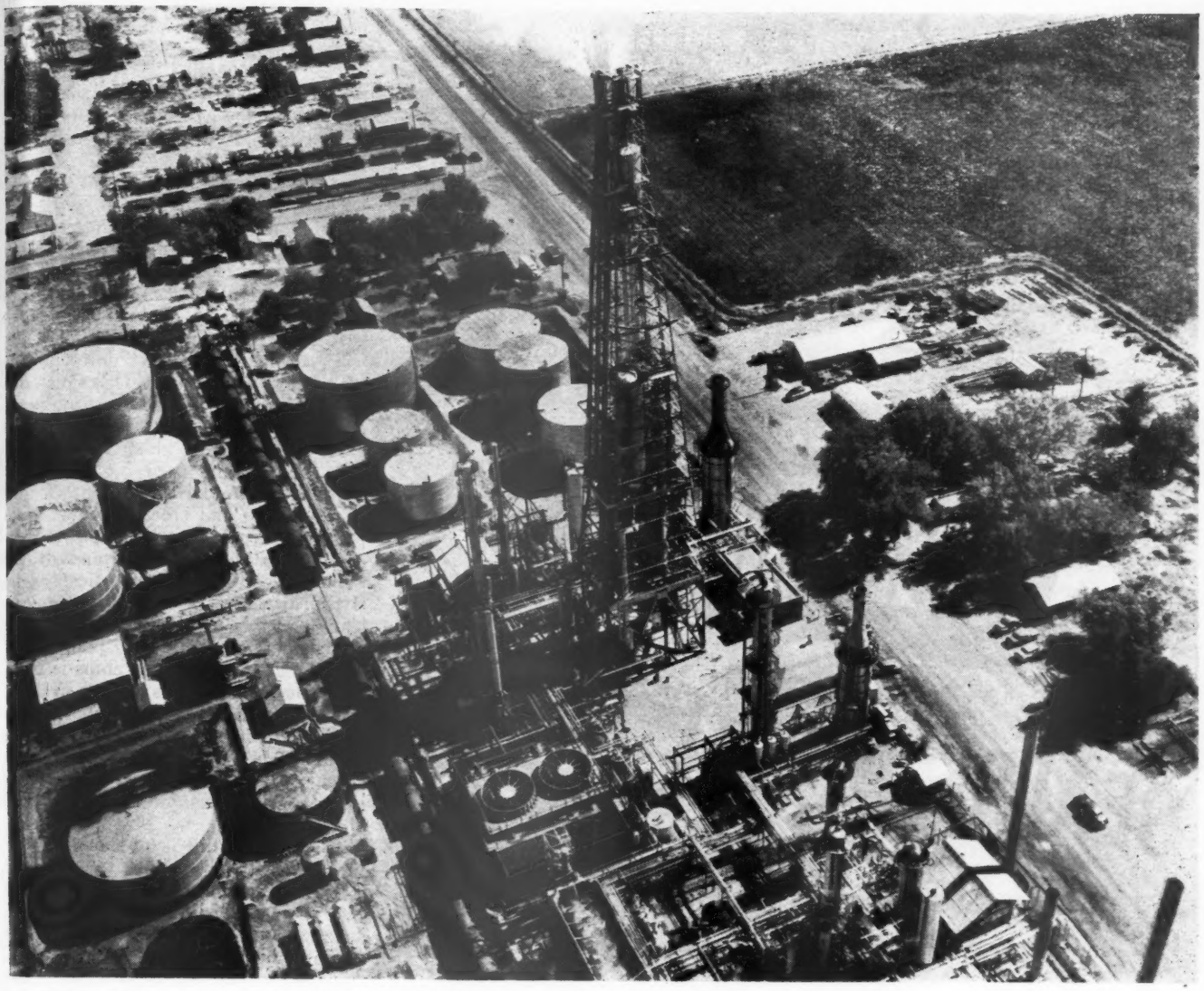
(4) In the regenerator, this coke is burned in the presence of air in a fluid bed. The regenerated catalyst then flows to the reactor, completing the cycle.

Because of the importance of balance between the flow of the catalyst that also serves as the heating medium, the quantity and quality of the steam that heats the catalyst is of primary importance. A second important control medium is the relative height of the catalyst level in the stripper. The latter factor is the primary means for controlling the operation; a constant level of catalyst in the stripper is a primary objective, with the differential of spent catalyst heights serving as the control medium.

Primary Fractionator

The fractionator consists essentially of two divisions. The upper half contains 16 bubble trays. Below these and about half way up the tower is a ring section which allows about 18 in. of liquid to collect inside this ring pan. Immediately below this pan and below the center of the open ring is located the spray nozzle of a gland oil return line and an oil line taking suction on a higher plate in the fractionator. Also, in the base of this fractionator and operating as an overhead open stream heating element is a series of steam nozzles through which passes approximately 500 lb steam per hour, at a pressure of about 40 psig.

Four other towers are employed to complete the fractionation. In addition to the normal use of heat exchange between the various streams, a refrigerant, freon, is used as coolant in two exchangers serving the absorber stripper. A stream of approximately 2750 bbl of light liquids is pumped continuously over the top of the absorber stripper tower, suction is taken on the 3rd plate and this stream cooled to 50 F by means of a freon exchanger and returned to the 4th plate. By so doing, the normal inlet from the upper plate is approximately 78 F, while the oil going to the lower plate or 4th as previously mentioned, is approximately 50 F. Off the base of this absorber stripper is a line carrying 5510 bbl per day of material at 220 F to the mid-section of a 30 plate debutanizer. *



Packaged TCC unit completed and on stream at Artesia, New Mexico, refinery.

P 721.36

First Packaged TCC Unit on Stream

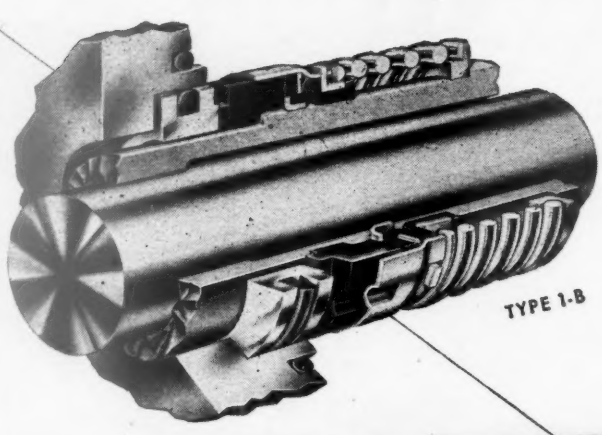
Costs are reduced by shop fabrication, standardizing flow sheets, and pre-engineering large part of plant

THE first package type TCC catalytic cracking unit was completed recently for New Mexico Asphalt and Refining Company at Artesia, with a rated throughput capacity of 6000 bbl of fresh feed per day. The unit was designed and built by Southwestern Engineering Company, the design being based on the developments by Socony-Vacuum Oil Company, Inc., originator of the process. The unit includes feed preparation, catalytic cracking section, fractionation, catalytic polymerization, and vapor recovery units. This unit introduces a new concept of refinery unit design, emphasizing especially shop fabrication and standardized units and equipment throughout. The new unit uses a double kiln instead of a larger single carbon burner, at a considerable saving in cost and with additional operating flexibility.

Costs are kept at a minimum by such expedients as the exclusive use of shop fabrication, standardization of flow sheets, pre-engineering of a large percentage of the plant, and a standard plot plan that can be modified slightly for particular conditions.

Another major cost cutting feature is the utilization of an oil well derrick type structure for the catalytic section. This is the first time a structure of this type has been used in refinery construction. The derrick is completely erected prior to the installation of vessels thereby keeping rigging costs at a minimum as the derrick serves the role ordinarily played by heavy rigging equipment that must be erected at the job site and dismantled on completion.

The modernization program of the New Mexico Asphalt and Refining Company at Artesia, New Mexico, included TCC feed preparation, 6000 bbl per day catalytic cracker, gas recovery unit, cat-



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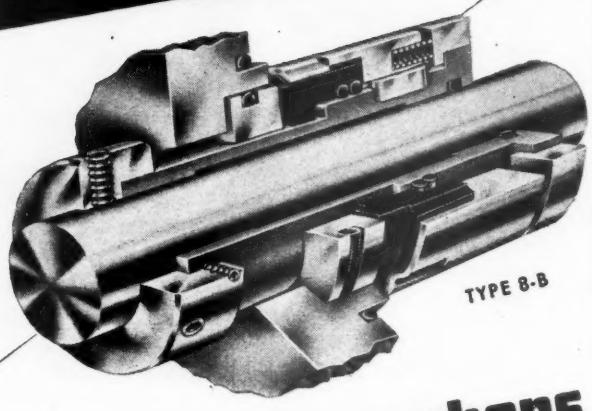

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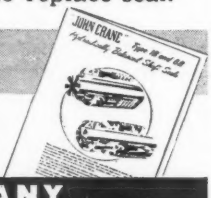

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alytic polymerization plant, and auxiliary installations to round out the refinery expansion.

The unit installed at Artesia has a nominal fresh feed capacity of 6000 bbl per stream day of gas oil, operating at approximately 55 per cent conversion level. The catalyst regenerator consists of two identical kilns each with a carbon burning capacity of 1650 lb per hour. The double kiln arrangement was desirable from the standpoint of flexibility of operation and in addition permitted complete shop fabrication, whereas a single kiln would have involved high cost field fabrication. The TCC unit incorporates all the latest developments of the Socony-Vacuum Oil Company, licensor of the TCC process. Catalyst is conveyed through the unit by means of an air lift system, which replaces the elevators formerly used.

In addition to the TCC unit, SWECO also designed and erected a new liquid phosphoric acid catalytic polymerization unit developed by Standard Oil Company of California and licensed by Hydrocarbon Research, Inc. The unique feature of this process is the utilization of commercial liquid phosphoric acid catalyst. A bed of quartz chips is filled with phosphoric acid and then drained, leaving a film of catalyst deposited on the quartz. In this manner the handling of high cost impregnated catalyst is eliminated. On-stream time compares favorably with that of older solid catalyst processes.

The Numex unit is operated in conjunction with the crude topping and thermal cracking units. Charge to the catalytic cracker is a combination of reduced crude from the topping plant and whole crude. Products from the TCC and poly plants are high octane catalytic gasoline, poly gasoline, LPG, and cracked cycle oils, which are further processed in the Numex thermal cracker.

* * *

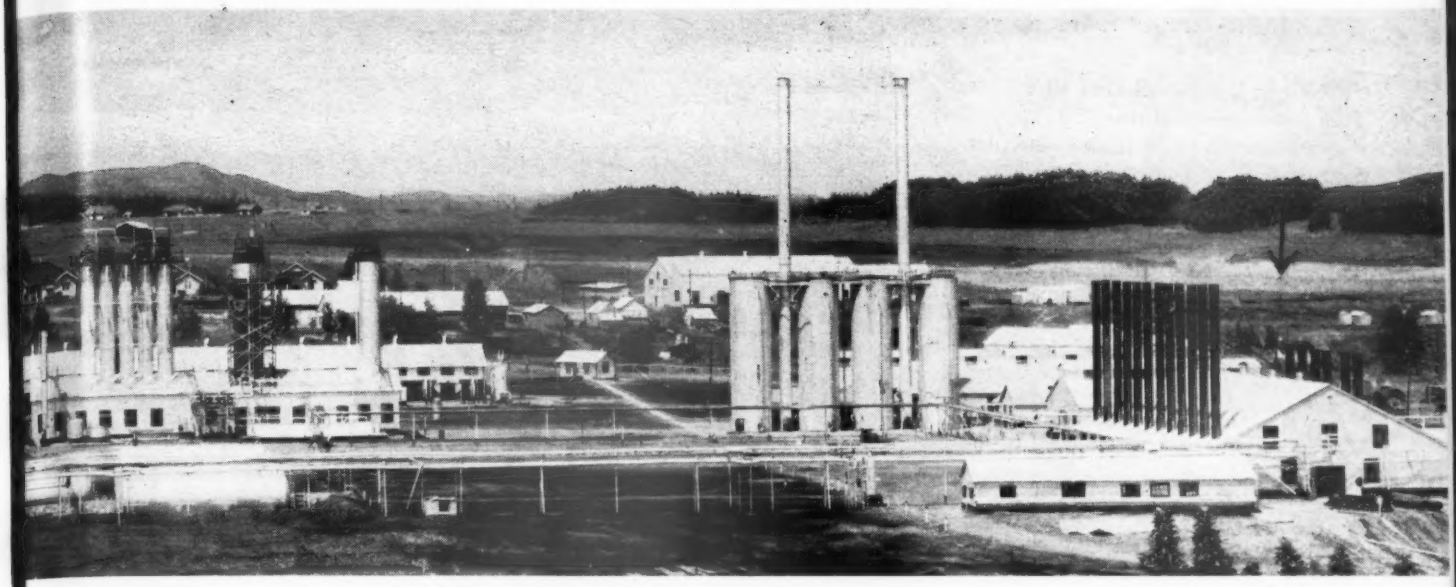
Bureau Reports Tests On Colorado Oil Shales

Completion of an analytical study of Colorado oil-shale was disclosed recently when the Bureau of Mines published the results of tests of samples on two series of oil shale from the Mahogany Ledge of the Green River formation near Rifle, Colorado.

The six-year study began in 1945 to bolster production of synthetic liquid fuels. It was undertaken to determine the character of the various grades of oil shale that are being mined and processed into shale oil and refined products at the Bureau of Mines Oil-Shale Demonstration Plant at Rifle, Colorado.

The report shows that the organic material in minable-bed shales yielded, on the average, 66.3 per cent oil, 9.1 per cent gas, and 24.6 per cent organic residue. Data on sulfur and nitrogen occurring in the shale are also given.

A free copy of RI 4825, "Properties of Colorado Oil Shale," may be obtained from Bureau of Mines, Publications Distribution Section, 4800 Forbes Street, Pittsburgh 13, Pennsylvania.



Left to right are: Formerly Seaboard scrubbers—now converted to Girbotol service; Girbotol scrubbers; Girbotol reactivators, the one on the right being a new addition; main compressor station; Seaboard actifiers, (these have now been removed); H_2S and CO_2 disposal stacks, one of which will be retained to vent excess H_2S and CO_2 during peak loads; boiler plant; arrow indicates location of sulfur plant behind and to the left of the boiler plant; natural gasoline storage tanks for the Royalite gasoline plant left foreground; Royalite No. 1, originally Dingman No. 1, the discovery well (center and right in foreground).

New 30-Ton Sulfur Recovery Plant at Calgary

Thirty million to one hundred million cubic feet of sour gas per day to be purified and the sulfur recovered

HARRY CHAPIN PLUMMER

THE Royalite Oil Company Ltd. of Calgary, Alberta, expects to bring into operation in April, a sulfur recovery plant now under construction at Turner Valley in that Province. This is a realization of the aim of scientists and engineers for many years to separate sulfur from hydrogen sulfide by the addition of water to form oxygen and elemental sulfur.

The new unit, to be an addition to the existing adsorption and scrubbing plants at that point, will utilize the acid gas stream containing hydrogen sulfide presently being vented to the atmosphere, as feed. The acid gases are removed from the natural gas in the Girbotol scrubbing plant, owned and operated by the Madison Natural Gas Company, property of the Royalite Company, which uses a monoethanolamine water solution as a scrubbing medium.

The sulfur plant, to be operated by the Royalite Company, is to be fabricated by Foster-Wheeler Limited, St. Catherines, Ontario. It will have a design capacity of 30 long tons of elemental sulfur per 24 hours and will be erected in close proximity to the Turner Valley compressor station of the Madison Company, largest in Western Canada. Fabrication of the sulfur recovery buildings will be carried out by the Dominion Bridge Company of Calgary.

Intense Winter Cold Dictates Partial Housing

Conforming to the extremes of the Alberta climate, Royalite's gas operations vary from a flow of 100,000,000 std cu ft per day in winter to 30,000,000 in summer, with a 15 per cent daily variation. So the plant is to be rendered flexible from an operating standpoint and since it must function continuously in the severe cold weather of that area, the steam generating and sulfur condensing plant will be partially housed. Also, the combustion air-blower and the control equipment will be installed in the housing. The air for reaction must be metered continuously to suit the variation in acid gas flow.

The building will be heated by steam generated by a waste-heat boiler in the plant. Boiler, converters, economizers, and towers will be insulated with rockwool covered with Sticktite. All steam and water lines will be covered with 85 per cent magnesia and all sulfur flowlines steam-traced. The vessels will be mainly of carbon steel. Very little alloy will be used. The building itself will be of a steel transite construction. All refractory materials will be fire brick.

An appreciable volume of heat is liberated in recovering sulfur from hydrogen sulfide and the success in commercial recovery of sulfur is materially aided by the utilization of the waste heat. Saturated steam will be generated at 225 psig. So as to insure continuity of operation, all main drives will be by steam turbines, thus eliminating possible shutdowns from power failures. As the Girbotol plant uses steam at 25 psig for MEA regeneration, turbine drives will exhaust at that pressure. Foster-Wheeler's more than half a century of experience in the designing and building of waste-heat boilers, economizers and heat-recovery equipment has been

EXCLUSIVE

brought to the present sulfur recovery process.

Unscrubbed Natural Gas Virulently Poisonous

As hydrogen sulfide in the concentration existent in Turner Valley natural gas is virulently poisonous and a grave hazard to human and animal life because it causes paralysis of the nervous system, the removal of the acid gases from the natural gas become an imperative necessity. It is for that reason that Government regulations forbid the sale or use of unscrubbed natural gas containing H_2S as a fuel.

Average analyses of natural gas in Turner Valley and acid gas feed to the sulfur plant are:

Average analyses of natural gas	% by Volume
Methane	81.00
Ethane	8.36
Propane	3.19
Iso-butane	0.49
N-butane	0.95
Iso-pentane	0.17
N-pentane	0.17
Di-isopropyl plus	0.23
Hydrogen sulfide	2.58
Carbon dioxide	2.86
Total	100.00
Average analysis of acid gas feed to sulfur plant	
Hydrogen sulfide	38.8
Carbon dioxide	54.8
Hydrocarbons	2.9
Water	3.5
Total	100.00

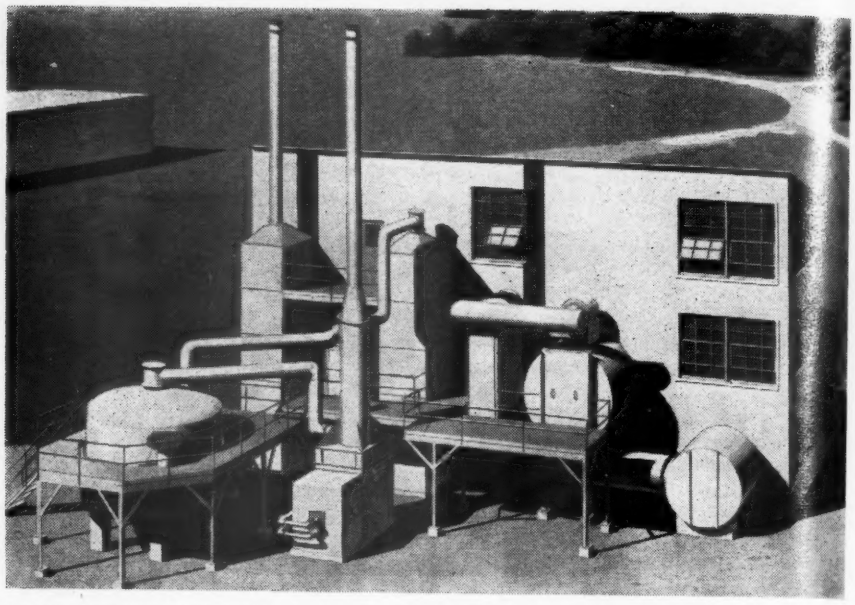
Source of Wet Gas in 67-Mile Lines

Comprising approximately 67 miles of line the Madison gas gathering system transports wet gas from the 195 Turner Valley wells to the processing plant, which cleans the gas in a Girbotol unit, using monoethanolamine (MEA) solution as an absorption medium. After the solution absorbs the hydrogen sulfide and carbon dioxide in the wet gas, the clean gas is distributed to consumers by the Canadian Western Natural Gas Company Limited, a local organization. The gathered gas is raised in pressure from 90-125 psig to 335 lb by means of 10 Cooper-Bessemer compressors, totaling 5720 hp at an altitude of 4000 ft in Turner Valley, or 6600 hp at sea-level.

The MEA absorber-solution is regenerated by boiling off the H_2S (hydrogen sulfide) and CO_2 (carbon dioxide), which is released as waste to the atmosphere; the regenerated solution is returned to the absorber.

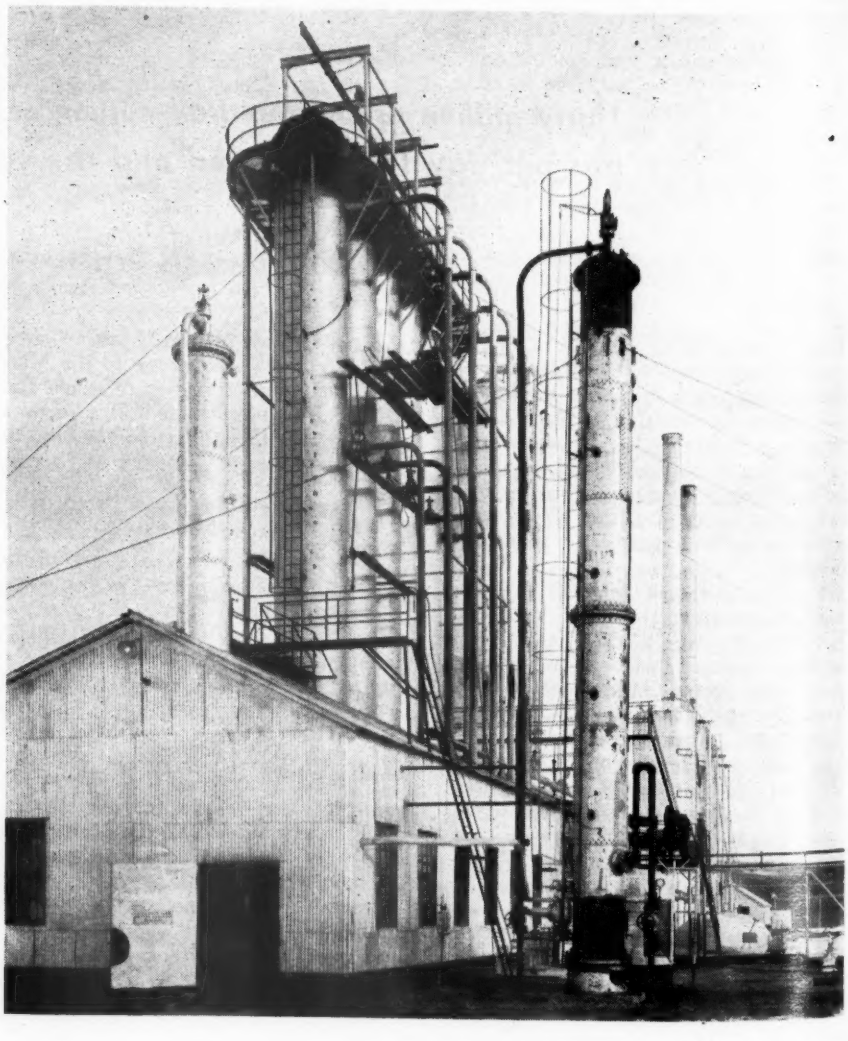
The waste gas analysis by volume, dry basis, is approximately 40.2 per cent H_2S 56.8 per cent CO_2 and 3.0 per cent hydrocarbon. The gas to the sulfur recovery unit flows at 10 psig saturated at 80 F. For a capacity of 30 long tons per day sulfur equivalent, that represents a design acid gas capacity of 2,130,000 std cu ft per day.

Cognizant of the fact that hundreds of tons of sulfur were being released to the atmosphere, research chemists and chemical engineers for years have striven to find an economically profitable means of recovering the valuable element. For some time chemists had



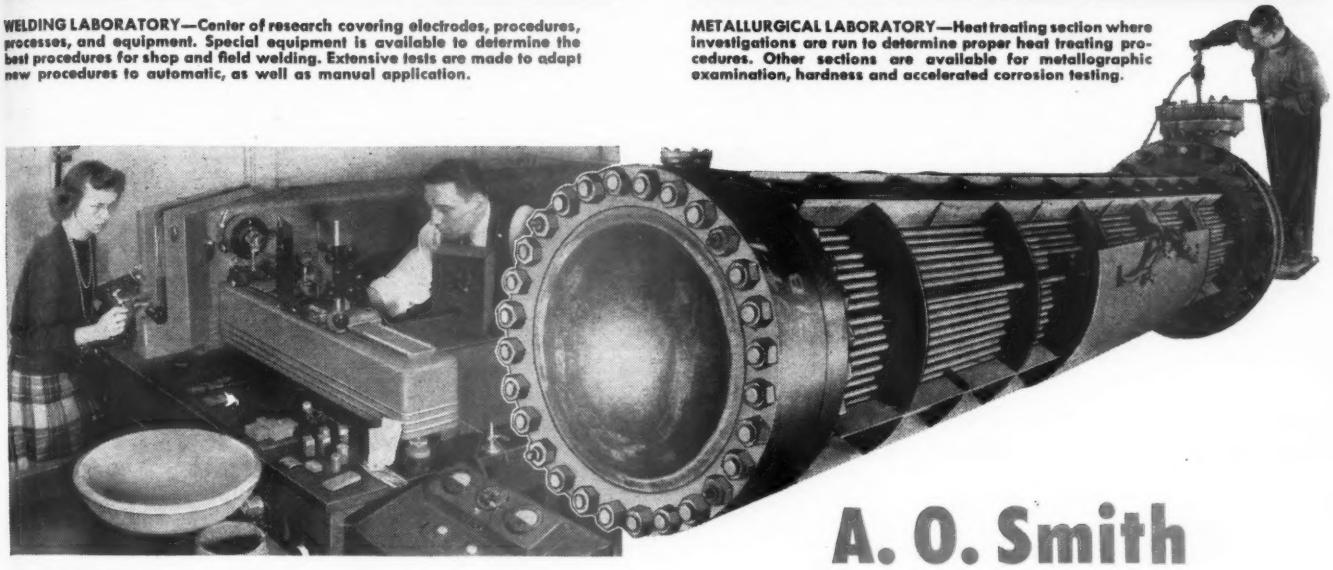
Artist's drawing of the sulfur recovery plant as it will appear in Royalite Oil Company's plant at Calgary, Alberta, Canada.

Girbotol unit with compressor station and Girbotol reactivators and disposal stacks in background.

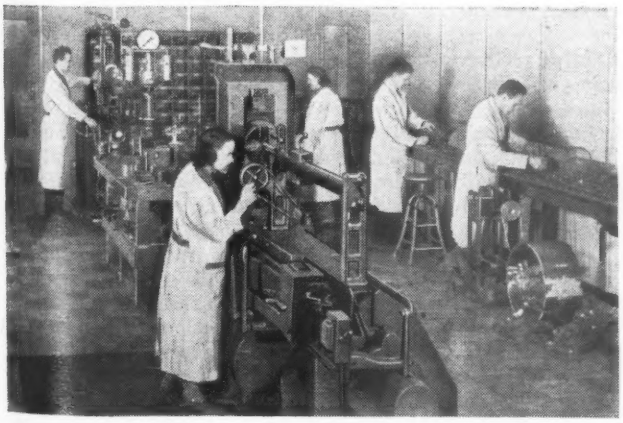


WELDING LABORATORY—Center of research covering electrodes, procedures, processes, and equipment. Special equipment is available to determine the best procedures for shop and field welding. Extensive tests are made to adapt new procedures to automatic, as well as manual application.

METALLURGICAL LABORATORY—Heat treating section where investigations are run to determine proper heat treating procedures. Other sections are available for metallographic examination, hardness and accelerated corrosion testing.



SPECTROGRAPHIC and X-ray diffraction equipment is used for exacting analysis of materials and manufacturing processes. They are also used in special investigations relating to heat exchanger research projects.



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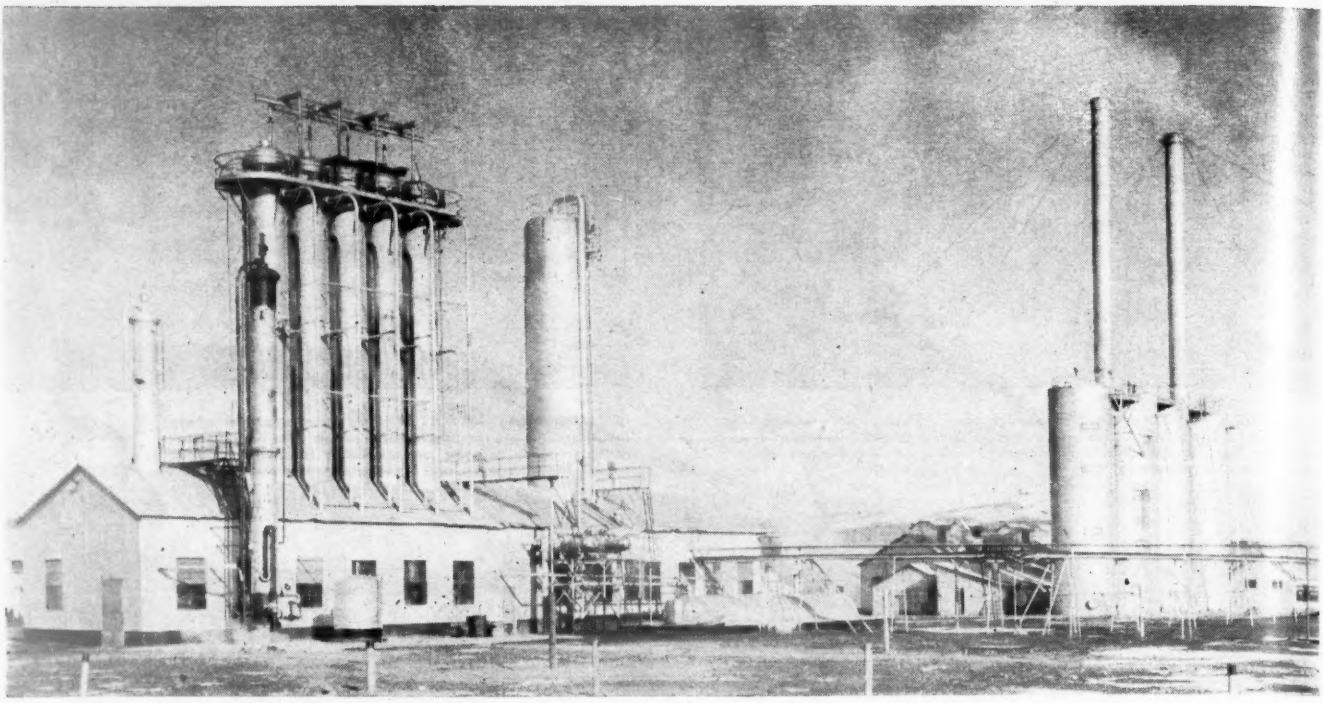

Gas purification plant of Madison Natural Gas Company, Ltd., Turner Valley, Alberta, Canada.

known that sulfur could be separated from hydrogen sulfide by the addition of oxygen to form water and elemental sulfur. Chemically speaking, the reaction is:

$$2H_2S + O_2 = 2S + 2H_2O$$

(hydrogen sulfide plus oxygen from the air equals sulfur plus water)

Underground sulfur deposits are natural formations and the extraction of sulfur by an ingenious device was first developed in Texas and Louisiana. Hot water was introduced into the wells to melt the sulfur and compressed air forced the molten material to the surface. That method of mining, known as the Frasch process, reduced the price of sulfur to the point where other methods of manufacture became too costly. But with primary supplies relatively limited, more and more uses were found for sulfur in modern industry. It is estimated that the current demand for sulfur is all of 1,000,000 tons short of today's annual production. And the demand is primarily in the manufacture of newsprint, an item of cardinal importance in the economy of Canada, in the production of sulfuric acid, in the manufacture of synthetic rubber, insecticides, fertilizers, textiles, and many other products.

World Market Appears Certain for Years to Come

The decision to install a recovery plant at Turner Valley seemed to be a natural one. There is an adequate source of hydrogen sulfide. A world market appears to be certain for years to come. The mode of converting hydrogen sulfide to elemental sulfur not only has been tried, but proved scientifically and commercially.

The first successful commercial recovery plant utilizing acid gas was designed and installed in the United States by Foster-Wheeler Corporation in 1944. It has a sulfur capacity of 75 long tons per day. Subsequently several similar plants have been built and brought into operation. The largest of its type was designed and installed by Foster-Wheeler Corporation for the Texas Gulf Sulfur Company in Worland, Wyoming —its sulfur capacity 400 long tons per day.

In the Foster-Wheeler sulfur recovery unit the acid gas, now being released to the atmosphere, will be burned with air in stoichiometric proportions, to produce elemental sulfur in the reaction furnace. The vapors are cooled initially in steam generating equipment where some condensation takes place.

Two Cooling Processes

The condensed sulfur and vapors are passed to a wash tower using liquid sulfur as a cooling medium. There the sulfur vapors and condensed sulfur are further cooled to a temperature of approximately 275 F. When it leaves the first wash-tower the gas stream contains unreacted hydrogen sulfide, sulfur dioxide, carbon dioxide, water vapor, and other reaction products. It moves to a natural gas-fired reheater, where its temperature is raised to approximately 500 F. Increased recovery efficiency to a minimum of 90 per cent is obtained by passing the gas through the converter containing a bauxite catalyst. Sulfur produced in the converter is removed in the second wash-tower and the spent gases vented to the atmosphere. The condensed sulfur, as created, flows directly to a rundown tank from which the sulfur may be stored for shipment as a liquid or transported to a dry storage pile, for shipment as bright yellow sulfur.

The production from that plant will be marketed as bulk sulfur and will be trucked 17 miles to railhead at Okotoka, for shipment to various points in Canada. Sulfur has a freezing point of 235 F. At temperatures above 300 F it becomes extremely viscous, making pumping and handling difficult. The design of a sulfur recovery plant must consider these inescapable characteristics. Precaution must be taken in the design to insure against freezing of sulfur in the system as well as providing for holding any condensed sulfur at the proper pumping and handling temperature of 275 F.

It is estimated that the Turner Valley plant, covering an area of 30 by 65 ft. will begin operations by April 1, if winter conditions prove to be not too severe to seriously delay erection. The sulfur recovered will be of 99.5 per cent or better purity and will be marketed in bulk form. * * *

LP-Gas Distribution

The oldest company distributing LP-gas ("bottled" gas) in America recently celebrated its 40th anniversary. This points up the amazingly short time it has taken for this industry to grow from an infant to a giant. Consumption of LP-gas in the U. S. was only 223,000 gal in 1922, the first year records were kept. It had jumped to more than three billion gallons in 1950.

Your questions on refining and gas processing problems answered here. Send yours in today!

THE TECHNICAL FORUM

Fluidized Bed Reactor Applications

Q The opportunity for seeking additional information from the Forum has not presented itself until now. I am writing a report on the chemical applications of fluidized bed reactors and should like to ask for a possible list of references on this subject.—R. C. M.

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Schreiber, S., M. G. Pelipetz and E. L. Clark (Paper, A.C.S. 120th Meeting Division Gas and Fuel Chemists, New York (9/3-7/51); Abstr. of Papers: 8-1) Paper not published. "Hydrogenation of American Lignites in a Fluidized Bed."

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Chem. Proc. v. *14*, No. 6:97 (June 1951) A fluidized process for the production of sulfur dioxide from pyrite has been developed by the Dorr Company.

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Hall, C. C. and L. F. Jolley (International Chem. Eng. v. 31:159-66 (April 1950) "The Fluidized-Solids Technique and Its Industrial Applications."

Kivnick, A. and A. N. Hixson (Paper, AIChE Regular Meeting, Minneapolis (9/10-13/50); Prog. Abstr.: 24-5. Paper not yet published. "Reduction of Nickel Oxide in a Fluidized Bed."

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Calculation of Reid Vapor Pressure of Binary Blends

In your Technical Forum department of the May 1951 issue, G. L. Farrar described the calculation of Reid Vapor Pressure blends. We have a method in use at our refinery which I thought might interest your Forum readers and I am enclosing a copy.

I believe our method to be a very useful simplification of the calculations outlined by Farrar. In essence, our method combines Farrar's Fig. 2 (Mol wt. vs. Grav. and BP) with the specific gravity to give a curve of Mols/Gallons vs. Gravity and BP. Also, our method condenses the entire calculation procedure into one equation.

Using Henry's and Dalton's Laws concerning partial pressures, a simple equation has been derived for calculating the Reid Vapor Pressures of gasoline blends. The equation may be used for (1) calculating the RVP of a known composition blend, or (2) calculating the composition needed to give a desired RVP.

From Henry's Law:

$p = PX$

where:

- p = partial pressure of component in the blend
- P = vapor pressure of the pure component
- X = mol fraction of the component in the blend

If X_A = vol % A in the blend, then:

- $X_A/100$ = gallons A / gallon blend
- $1 - X_A/100$ = gallons B / gallon blend

The mol fractions of A and B can be written as:

$$\frac{\frac{X_A}{100}\left(\frac{M}{G}\right)_A}{\frac{X_A}{100}\left(\frac{M}{G}\right)_A + \left(1-\frac{X_A}{100}\right)\left(\frac{M}{G}\right)_B} = \text{mol fraction of A}$$

where:

M/G = Pound mols per gallon

$$\frac{\left(1-\frac{X_A}{100}\right)\left(\frac{M}{G}\right)_B}{\frac{X_A}{100}\left(\frac{M}{G}\right)_A + \left(1-\frac{X_A}{100}\right)\left(\frac{M}{G}\right)_B} = \text{mol fraction of B}$$

Since Dalton's Law states:

P of the blend = Σ p of the components.

We can now write:

$$VP_{Blend} = \frac{\frac{X_A}{100}\left(\frac{M}{G}\right)_A\left(VP\right)_A + \left(1-\frac{X_A}{100}\right)\left(\frac{M}{G}\right)_B\left(VP\right)_B}{\left(\frac{X_A}{100}\right)\left(\frac{M}{G}\right)_A + \left(1-\frac{X_A}{100}\right)\left(\frac{M}{G}\right)_B}$$

This can then be simplified to give the final equation:

$$VP_{Blend} = \frac{X_A\left[\left(\frac{M}{G}\right)_A\left(VP\right)_A - \left(\frac{M}{G}\right)_B\left(VP\right)_B\right] + 100\left(\frac{M}{G}\right)_B\left(VP\right)_B}{X_A\left[\left(\frac{M}{G}\right)_A - \left(\frac{M}{G}\right)_B\right] + 100\left(\frac{M}{G}\right)_B}$$

Carbon Black From Oil For Rubber Manufacturer

Synthetic rubber without carbon black is like a dress shirt without starch; it has no stamina. Much of the recent improvement in synthetic rubber manufacture is traced to the carbon blacks used. The most important recent development in this field is production of carbon black from crude oil instead of from natural gas. One oil company says its newest "black", from oil, will produce tire treads having 20 to 50 per cent better wear resistance than similar treads compounded with the best carbon blacks previously available commercially.

The final equation above requires the following data:

1. Either VP_{Blend} or X_A.
2. M/G for the components. If the API gravity and the 50 per cent ASTM boiling point are known, then Fig. 1 will give M/G.
3. A means of converting from VP to RVP, such as Fig. 2.

The equation has been experimentally checked with the following typical results:

(1) 20 per cent Natural Gasoline and 80 per cent Naphtha

Gasoline data: API = 82.8
50% = 130°F
M/G = 0.0698 (Fig. 1)
RVP = 24.4
VP = 26.04 (Fig. 2)

Naphtha data: API = 47.8
50% = 302°F
M/G = 0.0525 (Fig. 1)
RVP = 1.2
VP = 1.5 (Fig. 2)

Calculated RVP = 6.2 psia
Actual RVP = 6.3 psia

(2) 50 per cent Polymer Gasoline and 50 per cent Naphtha

Polymer gasoline data: API = 67.7
50% = 211 F
RVP = 8.0

Naphtha data: API = 47.8
50% = 293 F
RVP = 1.3

Calculated RVP = 5.4 psia
Actual RVP = 5.2 psia

—Milton Brychok, *Chief Chemist, Rothschild Oil Company.*

FIG. 1. Mols per gallon versus gravity of petroleum distillates.

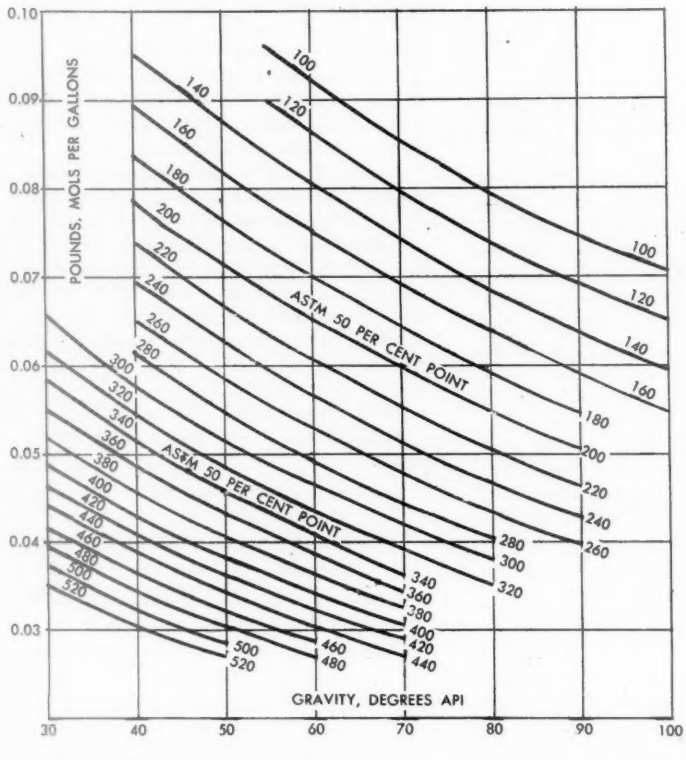
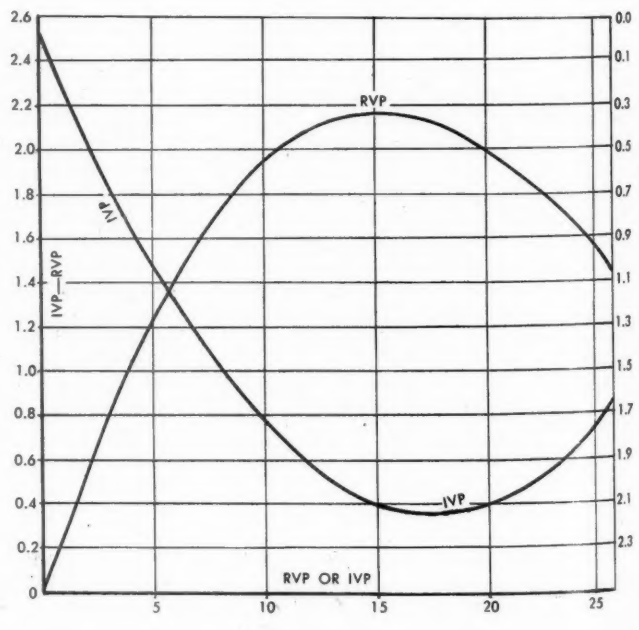
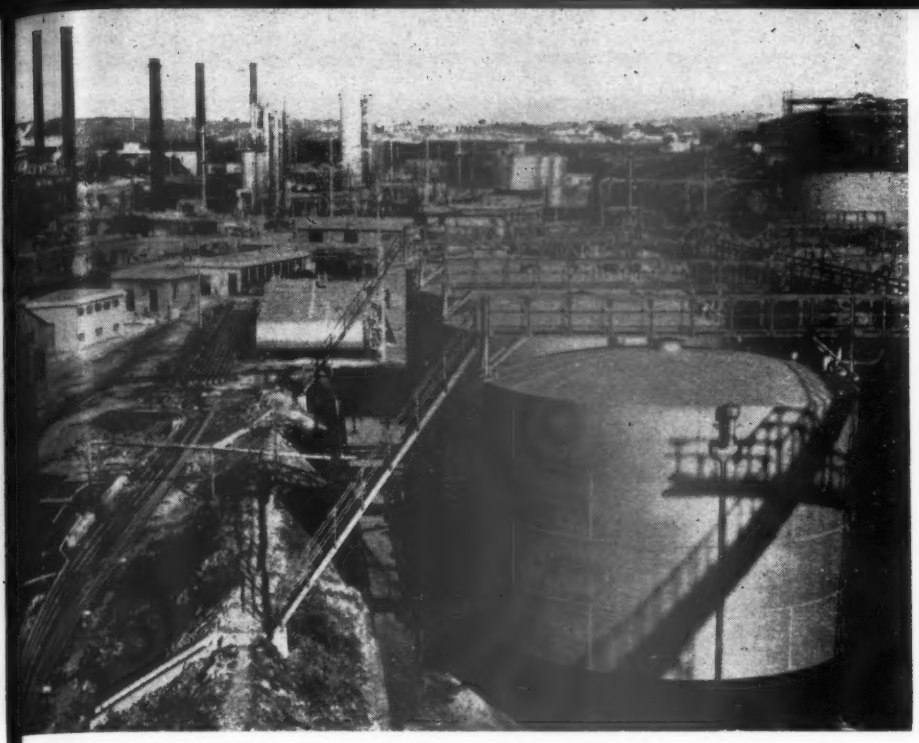


FIG. 2. Reid versus initial vapor pressure.





General view of refinery with storage tanks in foreground.

NEW DUNKIRK REFINERY

Facilities of two war-wrecked French refineries are combined and expanded to meet postwar needs

V. S. SWAMINATHAN

THE rebuilt and greatly expanded Dunkirk refinery went on stream in September, 1951. It is a completely integrated plant with a nominal crude input of 1,400,000 metric tons per annum (29,000 bbl per day). The main process units comprise a 26,000 bbl per day combination atmospheric and vacuum distillation plant; a 6000 bbl per day thermal reformer and gas recovery unit; a 600 bbl per day special products redistillation unit; two 6000 bbl per day copper chloride treaters, and a cut-back and emulsifiable bitumen plant capable of producing 75,000 tons per annum. Lubricating oil equipment consists of a propane deasphalting unit, a furfural solvent extraction unit, an MEK dewaxing unit and a high temperature clay contact unit designed to yield 55,000 tons (385,000 bbl) of finished oils per annum. Utilities are provided from high pressure steam boilers and pass out turbogenerators with a small input from the French grid system; while the cooling water plant consists of motor driven vertical pumps taking suction directly from the Dunkirk harbor turning basin.

The history of this new French refinery makes interesting reading. Between the two world wars two refineries operated independently in northeast France, on the fringe of a highly industrialized region, with a substantial and expanding market for petroleum products. Both were relatively small, processing less than 500,000 tons per annum of crude; but each manufactured a full range of products including liquefied petroleum gases, lubricating oils, and bitumen. Excellent rail and canal communications provided ample facilities for bulk distribution to depots dotted throughout the region served. The Dunkirk refinery was owned by Raffineries de Petroles du Nord (R.P.N.), a company controlled by Belgian interests. It enjoyed the advantage of a deep-water harbor in which ocean-going tankers could tie up within a few hundred yards of the shore tanks. The Courchelettes plant of Societe Generale des Huiles de Petrole (S.G.H.P.) was some 70 miles south of Dunkirk. Although better placed for distributing its products this inland refinery depended for its crude oil supply on two special trains of tank cars running daily between Dunkirk and Courchelettes.

In the spring of 1940 at the time of the evacuation of Dunkirk, both refineries suffered considerable damage, and were obliged to shut down. They remained largely inactive throughout the German occupation of France. Apart from the fact that initial destruction at the coastal refinery was much more extensive than at the inland plant, the Germans dismantled the remaining equipment at Dunkirk and transferred it

Dunkirk refinery 1940, damaged by bombing.

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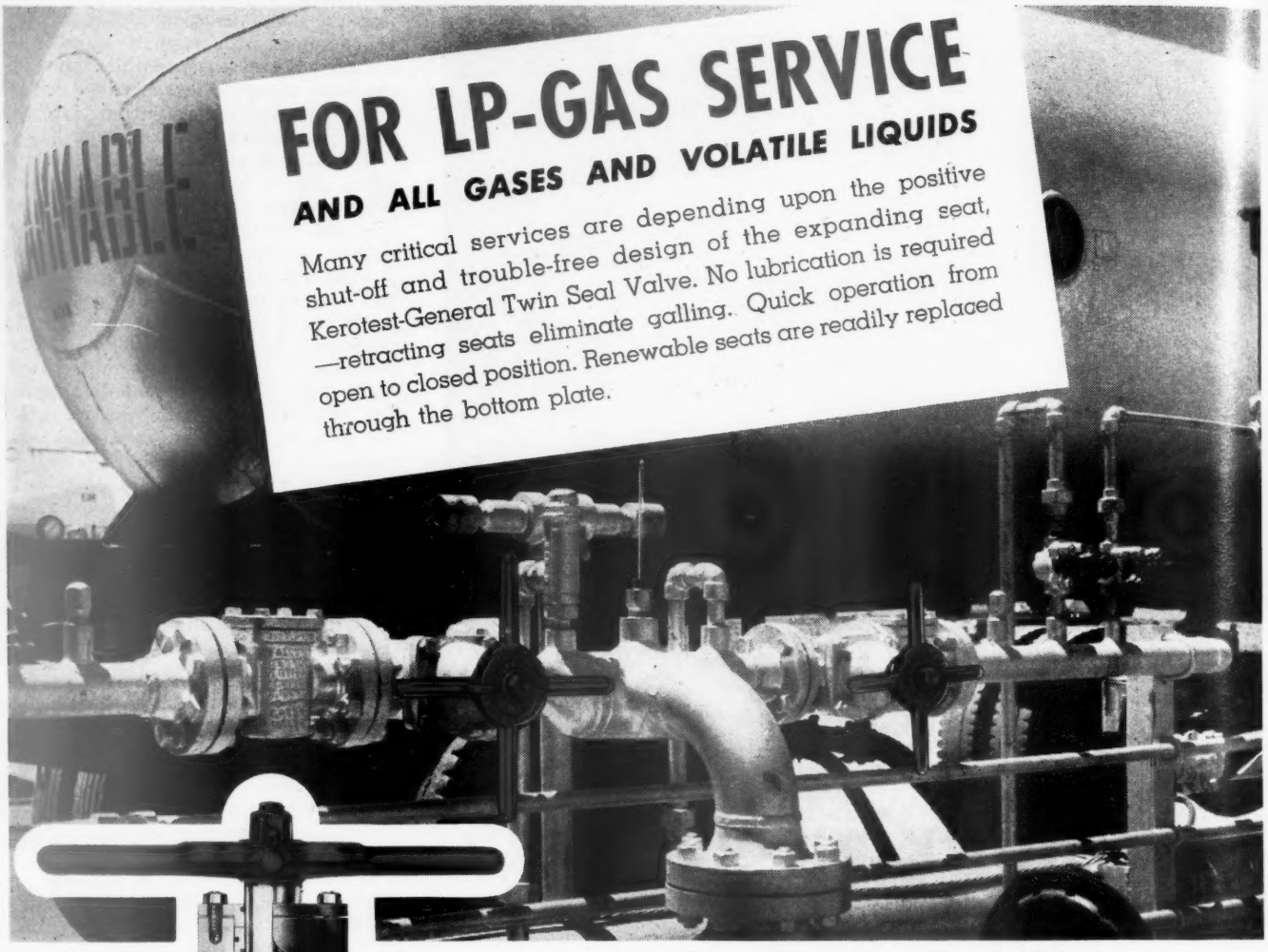
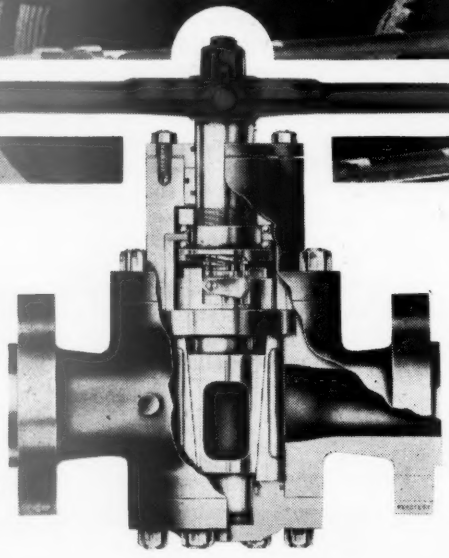


An installation of Kerotest-General Twin Seal Valves in an LP-Gas Loading Rack



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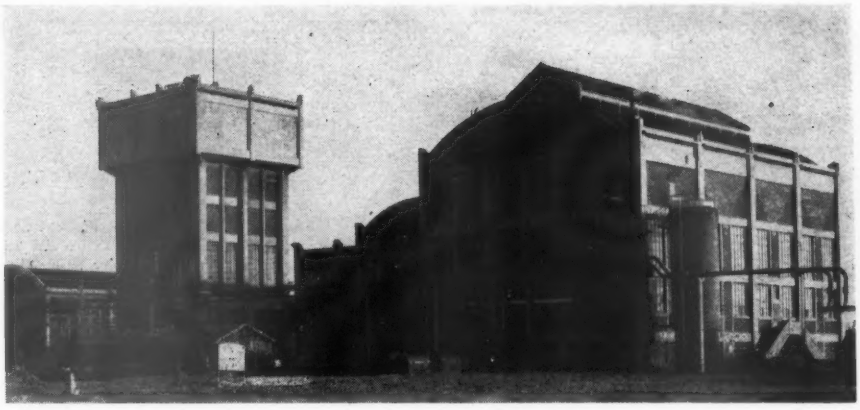
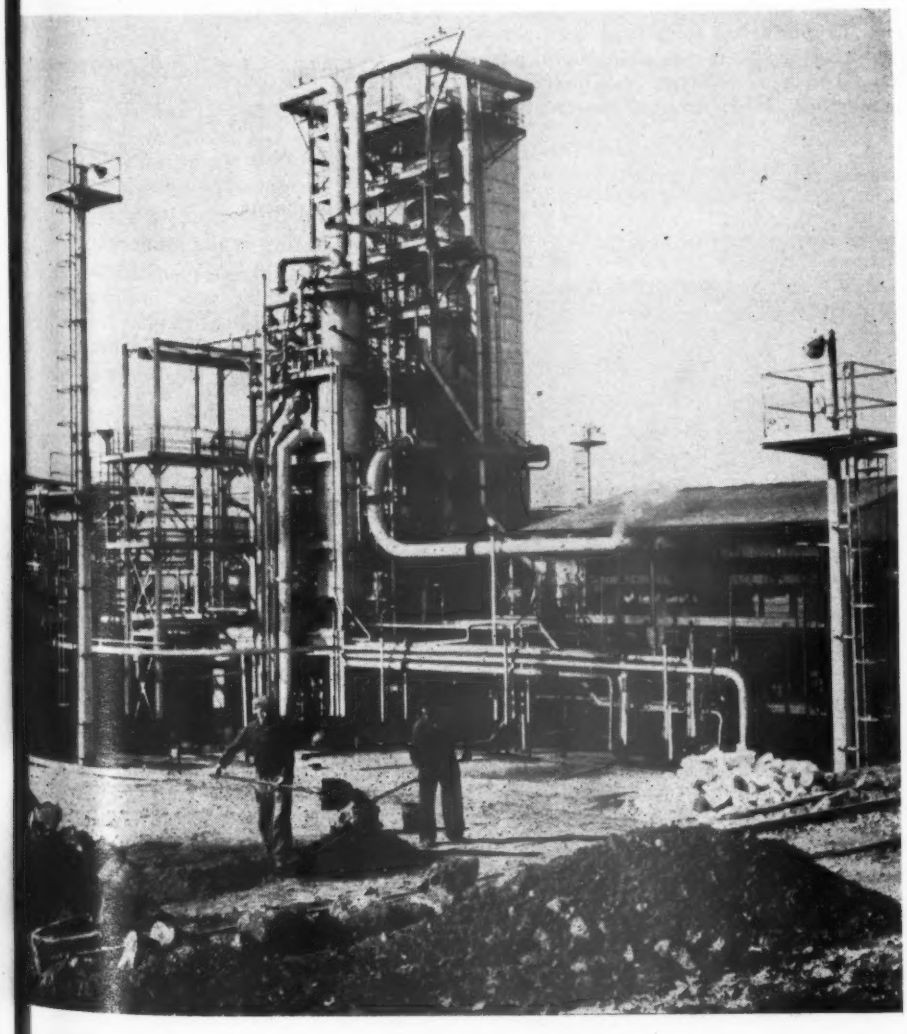
to the Reich and to Romania. At the end of the war the refinery site was bare but for the partially wrecked shells of the boiler house, laboratory, general office and the residential buildings on the adjoining housing estate. The Germans, under the Todt Organization, erected elaborate fortifications in the Dunkirk area, and set up the headquarters of their military command in the refinery manager's residence onto which was built an observation post. The house itself was later restored and brought into provisional use as a mess for the staff employed on the construction of the new refinery. Just before the liberation of Paris a concentrated bombing raid smashed up the lubricating oil plant, destroyed most of the power station and wrecked the tank farms; but caused only superficial damage to the main process units of the Courchelettes refinery.

When the question of the rehabilitation of the refineries in Northern France came up for consideration after the war, negotiations between SGHP and RPN took place, and agreement was reached, within the framework of the Monnet Plan, whereby the former acquired the RPN interest at Dunkirk and undertook to rebuild and operate a refinery there, the products from which would be allotted to the two groups in agreed proportions. It was proposed to combine the pre-war crude distillation capacities of the original Dunkirk and Courchelettes plants in a single larger unit at Dunkirk where the standard bulk products—motor spirit, gas oil and fuel oil—would be manufactured. It was also agreed to transfer lubricating oil distillates and certain residues to the inland refinery to utilize to the maximum the surviving equipment and facilities there, where the final processing of lube oils and a wide range of bitumens were to be undertaken. As the scheme developed it became apparent that to install the lubricating oil manufacturing equipment on the required scale at Courchelettes would result not only in an unsatisfactory layout on account of the awkward configuration of the site, but would also prevent any future expansion. The obvious solution was to extend the site at Dunkirk to build there all the plant that it was originally intended to split up between the two locations, and the decision to concentrate all producing units at Dunkirk was taken in the summer of 1948. And since development plans for the Dunkirk docks and railway sidings effectively prevented unlimited expansion of the main site, it became necessary to acquire two additional plots further to the west. The main site was, however, extended to 180 acres, and it is now devoted to process plant, intermediate tankage, maintenance and utilities, and oil dispatching, forming the refinery proper; while the larger of the new plots, covering some 68 acres, contains the crude and finished product tank farms. The third plot, of 20 acres, is reserved for future development. The space requirements of the new units, coupled with provision for expansion, necessitated a complete breakaway from the original layout, and involved filling up most of the hollows in which were situated the former tanks. This work called for over 1,000,000 cu yd of fill, obtained in the form of sand dredged from the habor turning basin. With the exception of a small part of the refinery tank farm, the whole of the site was raised uniformly by about 11 ft.



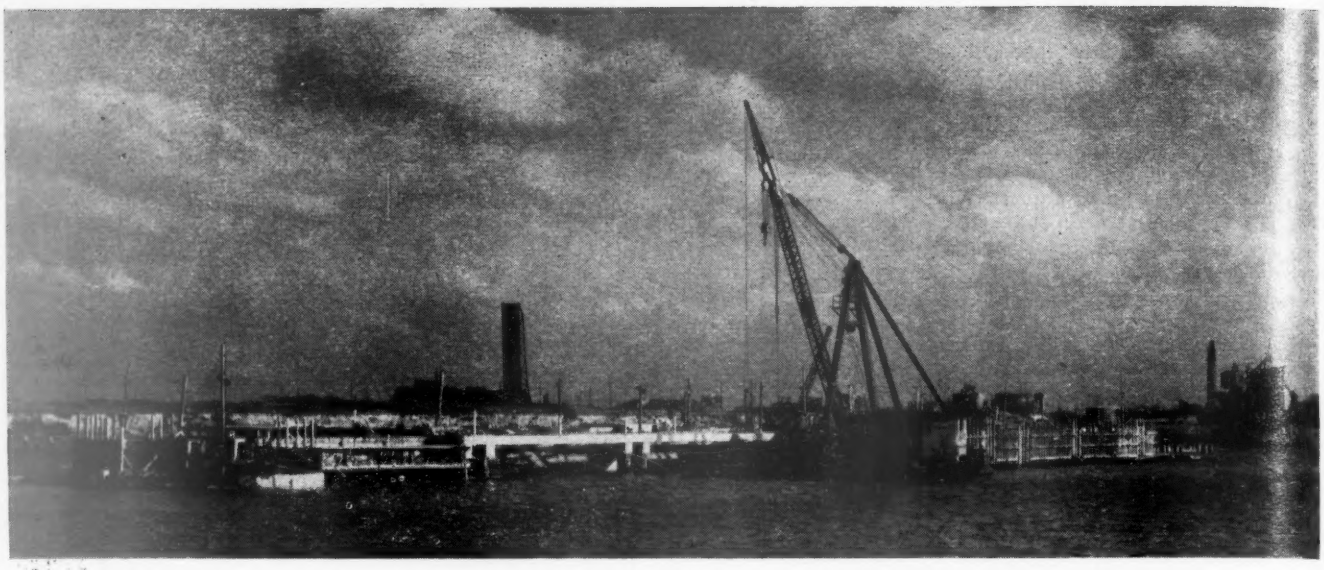
The laboratory at far left, water tower, old power and boiler houses.

Distillation unit at Dunkirk refinery in France.



The general planning and layout of the new Dunkirk refinery, as also the general services, storage, linkup piping and dispatching facilities, were developed by SGHP in collaboration with the Anglo-Iranian Oil Company Ltd. Design and erection of the new distillation units, the chemical treatment of the spirit, fabrication of lube oil and asphalt unit were entrusted to Lummus Company. M. W. Kellogg Company supervised the erection and were also responsible for the design of the naphtha reformer.

Lummus Company was responsible



View shows construction of the combined distillation plant at Dunkirk refinery.

for the erection of the atmospheric vacuum distillation unit, solvent redistillation unit, copper chloride treatment unit, those for the preparation of emulsifiable road asphalts, cutbacks, and industrial asphalt and lube oil plant. M. W. Kellogg Company dealt with the 6000 bbl per day naphtha reforming unit, while SGHP engineers designed and erected facilities for the separation and treatment of butane and propane; caustic soda and chemical treatment of light solvents and kerosine; bitumen barreling; wax treatment and packing, and for disposal of waste products.

The rebuilding and expansion of the refinery was executed in two stages. The first stage called for the transfer to Dunkirk of the small distillation unit, which escaped serious damage at Courchelettes, and construction of tanks with a capacity of about 1,000,000 bbl. Work began in November, 1948, and the topping unit was commissioned in February. This unit has since then been processing up to 1400 tons of crude oil per day. The second stage, completed in September, 1951, brought the treating capacity to 1,400,000 tons per annum of Middle East crude. Plans call for the manufacture of the following list of products:

Products	Thousand metric tons/year
LPG (C_3 and C_4)	21.5
Gasolines	311.5
Kerosines and solvents	12
Motor gas oil	129
Domestic fuel oil	91
Light fuel oil	90
Heavy fuel (1 and 2)	358
Lubricating oil	55
Wax	12
Various bitumens	137

Units operating at the refinery are:

(A) An atmospheric distillation unit, modernized, with a new stabilization tower and an additional gas-oil draw off with a throughput of 8800 bbl per day.

(B) A caustic soda treating unit for gasoline.

(C) A doctor treater for gasoline.

(D) A TEL unit for gasoline.

(E) A solvent redistillation unit (200 bbl per day).

(F) A double unit copper treatment of gasoline (6000 bbl per day each).

(G) Acid wash plant.

Although Courchelette will no longer function as a complete refinery, it will, however, continue to render a wide range of valuable services to SGHP through its extensive workshops, equipped to make and repair rail tank cars and "wagons" and fabricate many items of equipment required for the new refinery. It will also continue to be used as a distribution center for LPG, white and black products and lubricating oils, and will, by reason of its remaining units of processing plant, also be able if required to manufacture certain special products outside the normal production range of Dunkirk.

The new and larger boiler house has

Shunting and loading yard at French plant.

two Babcock and Wilcox boilers of 50-60 tons per hour, 485 C rated at 920 psig, heated by gas or fuel oil. These feed into two new passout and back-pressure turbines providing steam at 210 C and 56 psig. The auxiliaries have been so designed as to insure continuity of steam supply to the refinery. The feed water for the boilers is treated by double permutation and to a process for silica removal. The present turbine drives a 1600-kva 3000-volt alternator. Power is distributed at 3000 volts to the substations, where it is transformed into 380 volts. The large motors in the refinery are supplied direct from the substations at 3000 volts. Eventually two new alternators each of 6200 kva at 3000 volts will be driven by two new turbines. Peak loads and standby supply will be obtained from the national grid. A station with four compressors is now in operation. Compressed air is distributed in the refinery at 115 psig. A large pumping station (2,500,000 gal per hour) delivers sea water into the distribution network. The water is led to the pumping station by a syphon, 60-in. diameter and 330 yd long.

Other services include an extensive sewer system terminating in an API-type separator, fresh water, fire-fighting water, telephone, fire-alarm, and gas, and fuel oil networks. The 20 dwelling units acquired from RPN have been repaired, and a new club and mess buildings provided for the use of the staff. Some two miles from the refinery, in another suburb of Dunkirk, about 40 acres of land have been acquired on which a new estate for workers is being developed progressively, the goal being to house all key shift personnel up to a total of about 150 families.

Turning to dispatching facilities there is a marshalling yard with over 10 miles of track to permit the shunting and loading of 150 trucks daily. The railway siding is connected by a private branch line to the French national railway system. The railway network now serves a loading rack for black products comprising 16 loading points operating simultaneously and a similar rack for black products. To this is being added a rack for loading lube oils with 8 loading points; loading points for solvents, butane, propane, and asphalt; and platforms for loading asphalt in barrels and for handling wax in cakes. The old refinery was already linked to the navigable canal system by a connecting channel from the loading dock. These facilities permit the reception and dispatch of six barges a day at two loading stations.

For the first stage of expansion SGHP constructed in the turning basin of the Dunkirk harbor a jetty permitting the simultaneous reception of two tankers of the largest class, the depth always exceeding 37 ft. The loading station for the black products loads three tankers at the same time, and that for the white products, four. The refinery is connected by four 8-in. pipe lines over a mile long to a distribution depot serving several petroleum companies. * * *

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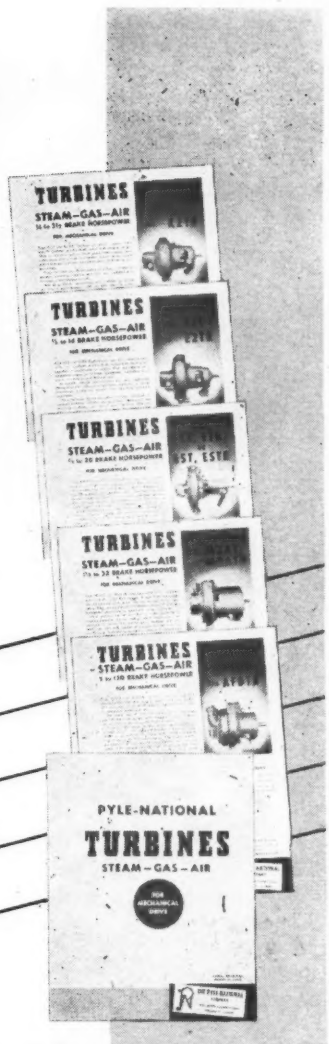

The Pyle-National line of highly efficient impulse type turbines has been recently expanded for general industrial use. These turbines are ideal for prime movers and standby drives on pumps, generators, and other equipment in refineries . . . also for drilling site equipment such as shale shakers, pumps, generators, bug blowers, etc. Types are available to operate on steam pressures from 70 to 450 lbs., at temperatures up to 750° F. Single or multiple nozzle combinations are furnished for speeds ranging from 1000 to 5000 rpm. Turbines are self-regulated for constant speed by a centrifugal governor, which is readily accessible for adjustment to maintain the specific speed desired.

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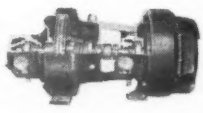

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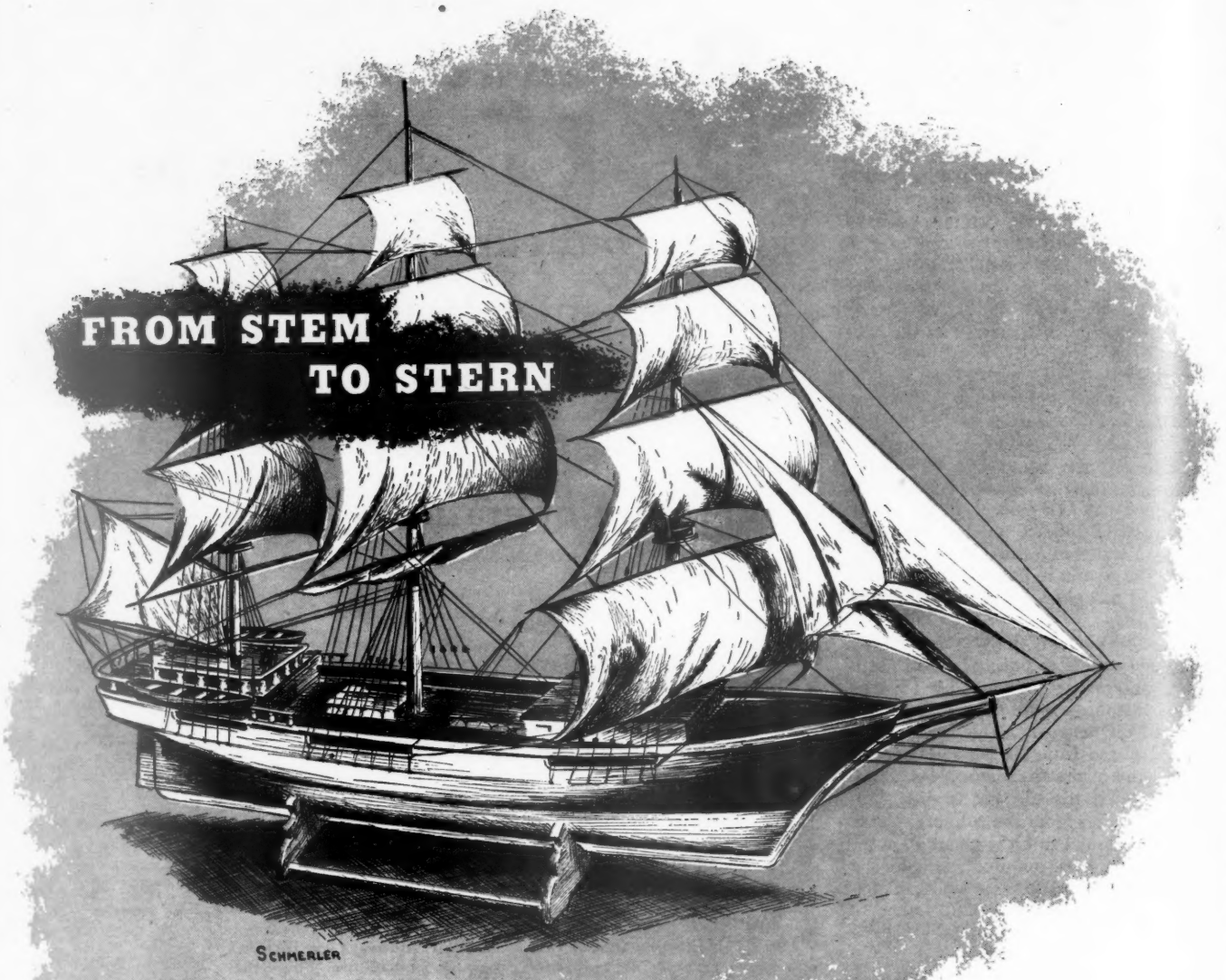

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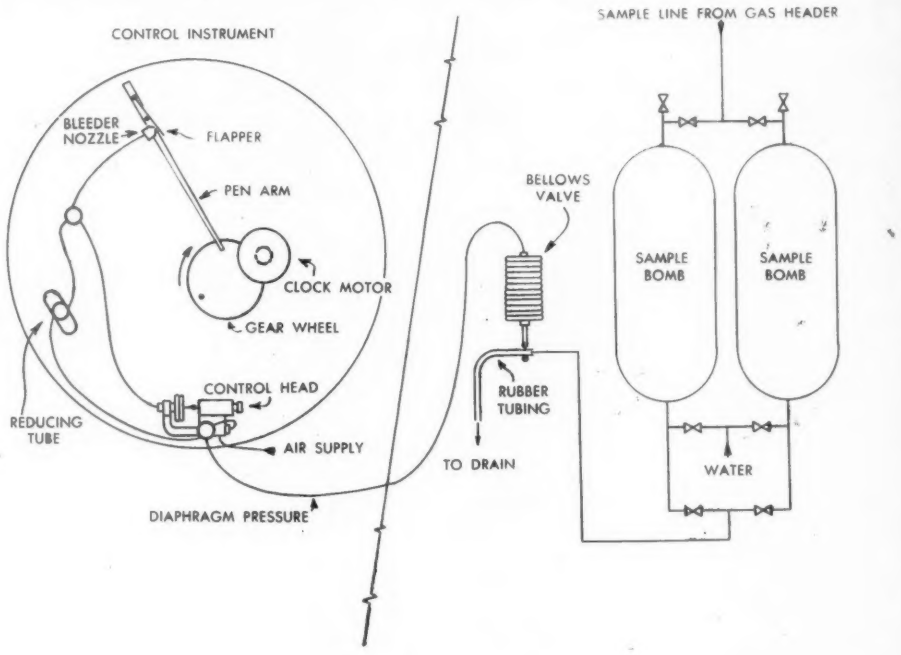
PLANT AIDS

Controller for 24-Hr Gas Samples*

ROBERT GENE PATTERSON† and DELBERT GRAY‡

Purpose: To alleviate difficulties in obtaining representative 24-hr gas samples.

We were having difficulty obtaining 24-hr gas samples by water displacement in 9-gal sample bombs. Needle valves were used to adjust the continuous water drain to a fast dripping. Too often the needle valves would choke off due to small grains of dirt or rust in the water. Since this method of taking samples continued to prove unreliable we rigged up the controller described below in an attempt to obtain representative 24-hr samples regularly. This was only one of several different methods which we considered but some were undesirable and costly. This controller has operated surprisingly well without additional attention.



An old temperature recorder-controller, which had not been used for a number of years since the process equipment it was on had been taken out of service, was utilized for construction of an interval controller. The electric clock in the instrument was dismantled and all the gears except one removed. The clock motor turned this gear wheel at a rate of one revolution every six minutes. A small rod was soldered near the outer edge of the gear wheel. The recording pen on the instrument was removed and a longer pen arm was cut off the proper length and put on. The pen arm was cut so that it would reach the outer portion of the gear wheel, and it was adjusted so that it was in the direction of the gear wheel. Thus, as the clock motor turned the gear wheel, the rod soldered on the gear wheel came around every six minutes and moved the pen arm a short distance. The pen arm would drop back to its normal position as the rod on the gear wheel moved on around. The pen arm was connected to the regular instrument pen shaft which in turn moved the flapper off the air bleeder thus causing the air pilot controller to release the diaphragm pressure. A diaphragm type off-on valve was constructed using the bellows out of this old instrument. The bellows, when expanded, pushed a steel rod against a piece of rubber tubing until the hole in the tubing was closed off. When the diaphragm pressure was released, the bellows contracted allowing the rubber tubing to open. The rubber tubing was fastened to the water drain connections on the sample bombs so that the water could be drained out through the rubber tubing when the bellows were contracted. When the renovated instrument was connected up, the electric clock wired up and the air supply piped in, the controller opened the rubber tubing for a few seconds each time the rod on the gear wheel picked up the pen arm and this was once every six minutes. This allowed water to be drained out of the sample bombs at six minute intervals and permitted collection of 24-hr gas samples by drawing into the bombs a small volume of gas every six minutes.

The adjustments necessary for proper operation seemed to be rather critical during the preliminary stage but when the controller was put into use it worked very precisely once it was set correctly. Since its installation it has operated for over two months without any additional adjustments. About 120 cc of water drains from the rubber tubing in approximately four seconds as it is presently set. It flows fast enough to keep the line flushed out and eliminates the clogging experienced with needle valves. So far, the controller has drawn the gas samples unerringly and has proved completely satisfactory.

*NGAA First Prize Winner—Class B.

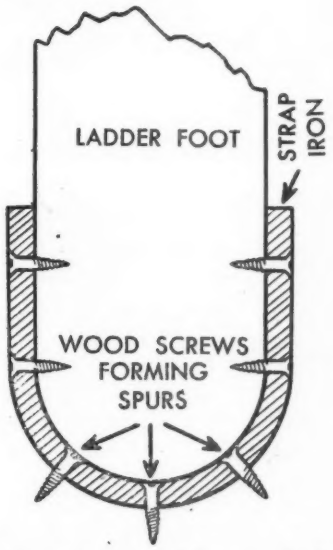
†Laboratory technician, The Parade Company, Overton, Texas.

‡Engineer, The Parade Company.

How to Prevent a Ladder From Slipping

Many an accident has been caused by the slipping of the foot of a ladder. This is particularly true when the ladders are used on slippery floors.

There are various ways in which this danger can be prevented—methods for holding the ladder base rigid. A simple and excellent method, shown in the sketch, can be made by any ladder user. A piece of strap iron is formed around the bottom ends of the ladder with holes countersunk for screws, as indicated. The screws which project outward through the strap iron hold the ladder in place while those that project inward hold the straps on the ladder feet.



To be sure, do not use a ladder of this kind directly on a polished or other floor that must not be marred. Place it on a non-slip plank or old wooden board. But make certain, above all, that there will be no slip of the base of the ladder or plank or board on which it is resting.—W. F. S.

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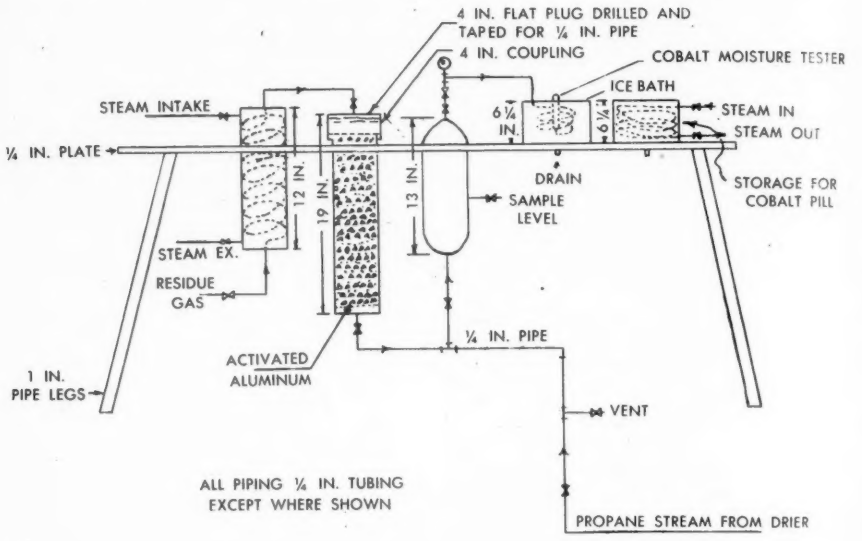
Dryer for Cobalt Moisture Tester and Sample Bomb*

H. L. BABER†

Purpose: To keep moisture tester and sample bomb dry.

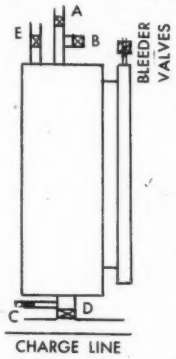
This apparatus was built to dry sample bomb and cobalt moisture tester on propane loading line. It was found that during damp weather our cobalt tester and piping would collect enough moisture to give us a false test. With this apparatus the piping, sample bomb and cobalt tester stay dry all the time. The apparatus was built of the following materials: One piece of ¼-in. steel plate 18 in. by 4 feet for the table top and four table legs of 1-in. pipe; gas heater constructed of 4-in. pipe 12 in. long with a coil of ¼-in. tubing inside with ends brazed to ¼-in. couplings at the top and bottom of heater for gas inlet and outlet; two ¼-in. couplings welded into side of heater for steam inlet and outlet, note slide for connections; gas dryer constructed of 4-in. pipe 13 in. long, the bottom welded flat and the top has a coupling with 4-in. flat plug. The flat plug was used in order to change the activated aluminum if it becomes contaminated. The flat plug was tapped for ¼-in. connection for tie in to dryer; ¼-in. connection at bottom of dryer for tie in to sample bomb; note connections on sketch; sample bomb made of 4-in. pipe 13 in. long with concave heads and ¼-in. connections at top and bottom and necessary valves and fittings to tie in lines and one pressure gage; ice bath container for cobalt tester constructed of 6-in. pipe six inches long and welded to the top of table and ½-in. drain connection in bottom of bath; storage for cobalt tester constructed of 6-in. pipe six inches long and welded to the top of table with a steam coil of ¼-in. tubing inside of vessel to keep tester dry. Note sketch for connections and tie ins for apparatus.

To test propane: The propane sample line is opened into the sample bomb at the bottom until the liquid reaches the desired level and the moisture tester is connected to the top connection and test run as specified by Natural Gasoline Association of America. After the moisture test, the bomb is vented, cobalt bromide tester disconnected and put into the storage dryer where the steam coil keeps it dry. The sample bomb is dried with the hot residue gas from the heater, passes through the activated aluminum bed, then through the sample bomb and piping connections for cobalt bromide moisture tester. Since this apparatus was installed the operators do not have any trouble with moisture in equipment due to weather conditions.



Pulsator on Solvent Dewaxing Unit‡

The centrifugal pump booster on the charge line to the MEK solvent dewaxing unit caused pulsations which broke welds, lost valuable lubricating charge stock and caused other problems. A pulsation dampener was installed which minimizes these pulsations effectively. The dampener is about 12 in. diameter, 60 in. high and has a 4-in. bottom inlet. Bleeder valve "C", bottom, is ½-inch; "E" at top is ¼-inch. The dampener was placed near the slop drum; a nitrogen bottle at "A" forces air out through the bleeders "C" and "E" which are then closed, nitrogen pressure is built up to the required valve, say 50 lb. valve "A" is closed, valve "D" opened and the charge pump is started.



S. T. GREENE, J. C. LYON

*NGAA Second Prize Winner—Class B.

†Chief operator, Gregg-Tex Gasoline Corporation, Longview, Texas.

‡This plant aid submitted through courtesy of the Humble Oil and Refining Company's Coin-Your-Ideas Plan.

NEWS

Gulf to Build New Acid Polymerization Plants

Contracts for a new sulfuric acid plant and a polymerization plant, to be erected at the Port Arthur, Texas, refinery of Gulf Oil Corporation, were let several days ago.

The new acid plant will have a capacity of 300 tons per day and will increase the acid-making capacity of the Port Arthur refinery by 150 per cent.

The unit will manufacture acid from sulfur by the contact method (over catalyst) and will also include acid sludge decomposing units for decomposing spent acid from the refining processes and converting it back to sulfuric acid. Both processes are based on Monsanto Chemical Company design.

The new polymerization plant will make a high octane gasoline from propylene, which is currently being burned at the refinery as fuel gas. High polymers (so called tetramers) produced by this unit also can be used in chemical industries for the manufacture of detergents and other chemicals.

Contract for the acid plant has been let to Leonard Construction Company, and for the polymerization plant to Bechtel Corporation.

Shell Chemical Steps Up Synthetic Glycerine Output

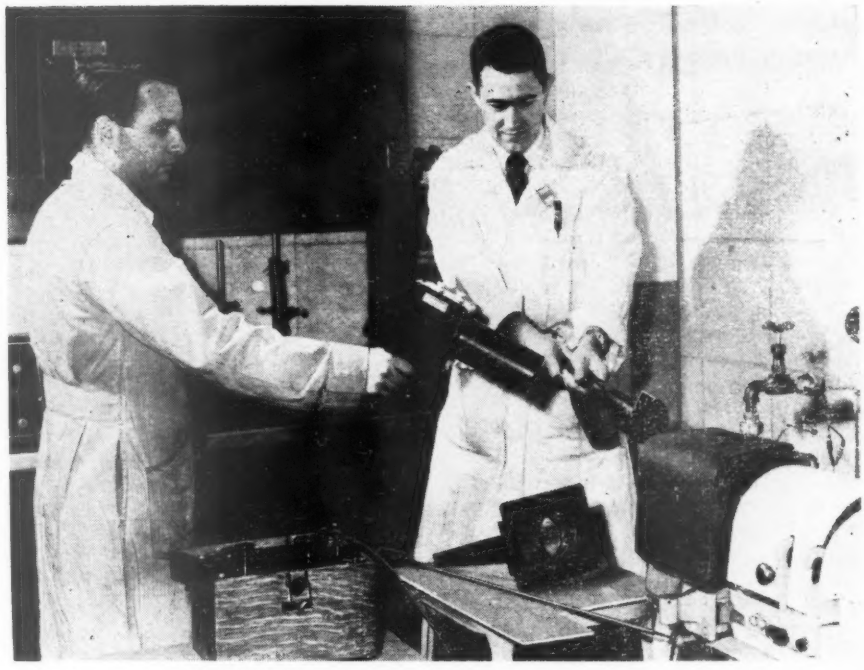
Installations increasing synthetic glycerine output by 50 per cent and ethyl chloride output by 30 per cent have been completed at the Houston, Texas, plant of Shell Chemical Corporation. The ethyl chloride addition also required an increase in the production of ethylene.

Operations commenced at the new units late in 1951 and the manufacture of these vital chemicals is rapidly nearing scheduled capacity. Synthetic glycerine, in heavy demand because of growing military needs, is necessary for use in explosives. It is also used in the manufacture of cellophane, resins and many other products.

Phillips Chemical Company Plans to Expand Plants

Phillips Chemical Company, the wholly-owned petrochemical subsidiary of Phillips Petroleum Company, has arranged with a group of banks for a $50,000,000 credit on a standby basis. Proceeds of this loan will be used to finance important chemical projects. These are a part of the company's long-range program of up-grading products and diversifying markets to improve values received from its raw material resources.

Part of the funds will be used to build the ammonia methanol and petrochemical plant near Houston, originally projected by the Alamo Chemical Company on which construction was recently begun by Phillips Chemical Company.



Straight from the atomic pile at Oak Ridge, a radioactive gear is about to be tested for rate of wear under vared lubrication conditions. The new technique, employed by Shell Development Company speeds up war tests and gives more accurate findings. Scientist at right handles the "hot" gear with special tongs, while his companion checks radioactivity with a Geiger counter.

"Hot" Gears Help Oil Research at Shell Development Lab

The Emeryville, California, laboratories of Shell Development Company, research affiliate of Shell Oil, have been engaged for some time in testing the wear of machinery gears under various lubrication conditions, but until recently it was a slow and tedious job. Every gear had to be carefully weighed and examined microscopically, both before and after testing it with a lubricant.

Now, by using radioactive gears, the testing process has been vastly simplified and speeded up. The new method is much more accurate, too. It works thus:

Shell scientists send their gears to the nation's number one atomic pile at Oak Ridge, Tennessee. The atomic energy technicians there bombard the parts with neutrons and rush the "hot" gears back to Emeryville.

A "hot" gear is meshed with an ordinary gear on a wear test machine, with different types of oils used as lubricants. As microscopic particles of radioactive metals are worn away, they are measured by Geiger counters on the oil stream. The amount of radioactivity indicates accurately the amount of wear.

Ordinary photographic film is also placed next to the ordinary gear later. If "hot" particles have been transferred to the "cold" gear's metal, indicating that the lubricating oil has failed to separate the gear-teeth, the fact shows up on the film.

Through such information, according to M. E. Spaght, president, Shell Development Company hopes to develop new lubricants capable of preventing gear wear under the high-speed and extreme pressure conditions characteristic of today's production machinery.

Lion Oil Expands Refinery at El Dorado, Arkansas

Lion Oil Company has announced a $5,000,000 expansion program at its refinery in El Dorado, Arkansas, to supplement existing manufacturing and operating facilities. T. M. Martin, company president, said that contracts are in preparation covering the design and construction of new process units, which will include a catalytic cracking unit with integral vapor recovery equipment and a 1150 bbl-per-day alkylation plant. The cracking unit will have daily capacity for 5000 bbl of fresh charge plus a like quantity of recycle charge.

In addition Lion will expand plant utilities with two steam generators, a 16,000 gal-per-minute water cooling tower, tankage and other various auxiliaries to serve the enlarged process capacity.

The announcement stated that the new cracker will be of the Fluid catalytic type and the alkylation plant will be the sulfuric acid type. The new refinery equipment will be situated within the present refinery enclosure near other process units and will utilize, to some extent, existing facilities.

Vickers to Double Its Kansas Refinery Capacity

A multi-million dollar expansion program to increase quality, volume, and distribution of its products has been launched by Vickers Petroleum Company, Inc., of Wichita, Kansas.

Scheduled for completion January 1, 1953, refinery expansion will involve increasing the size of the crude running facilities and adding a Thermofor catalyic cracking unit. Known as TCC, the unit was developed by the Socony-Vacuum Oil Company at a cost of several million dollars. It will be constructed by the Southwestern Engineering Company of Los Angeles. Capacity of the refinery will be 10,000 bbl a day when the expansion is completed, and George Armistead, Jr., of Washington, D. C., is the consulting engineer on the project.

Company officials said doubling of the refinery capacity will accomplish two major purposes. It will be advantageous to the company in handling its growing crude oil production and will enable Vickers to improve the quality of fuels as required by improvements in automotive equipment at any time in the foreseeable future. It will also increase the volume of high quality products, including aviation gasoline and jet fuels.

Besides doubling capacity of its refinery at Potwin, Kansas, and laying an 8-in. 13-mile pipe line from Potwin to El Dorado, the company is constructing new home offices in Wichita.

The Thermofor unit will increase product quality, especially in gasolines, and will increase substantially the quantity of raw materials used in the manufacture of alkalate, one of the principal ingredients of military grades of gasoline. The company can devote much of its production to jet fuels and military grades of gasoline.

Imperial To Modernize Regina Refinery

Tenders will be called early this spring for a $7,000,000 modernization program at Imperial Oil's Regina, Saskatchewan, refinery, according to W. O. Longworthy, superintendent of the refinery. It is expected that construction will be completed early in 1954. When completed, the refinery will have a capacity of 22,500 bbl daily, compared to 20,000 bbl now.

New units will include an 8100-bbl-a-day vacuum pipe still, a 7500-bbl-a-day Fluid catalytic cracking unit, a light ends plant and treating facilities, new steam generating equipment, and additional storage tanks.

Fluid catalytic cracking is a process by which gasoline of better quality may be extracted from crude oil. The vacuum pipe still will provide additional raw materials for the "cat cracker". At the light ends plant, gases from the processing units will be separated to produce butane, for blending with gasoline, and fuel gas. The refinery will continue to make the same major products.

Contract to build a new multi-million dollar catalytic cracking refinery was signed in Tulsa by Floyd L. Martin, left, Sunray vice president, and J. F. Thornton, president of The Lummus Company, New York, refinery processing engineers.

Sunray Refinery Contract Awarded to Lummus Company

Sunray Oil Corporation has announced that contract for construction of its recently announced multi-million dollar catalytic cracking refinery at Corpus Christi, Texas, has been awarded to The Lummus Company of New York and Houston. The new Sunray refinery will handle 28,000 bbl per day.

First preliminary construction work will begin immediately on the plant site some seven miles west of the port of Corpus Christi where Sunray operates deep water terminal facilities in connection with its coastal pipe line company operations. The project is scheduled for completion in 1953.

The heart of the new plant will be a Fluid-catalytic cracking unit according to process design by Universal Oil Products Company of Chicago. The refinery will also include alkylation and catalytic polymerization plants, process design also by Universal Oil Products.

South African Plant To Make Gasoline from Coal

Power and process steam for the first commercial plant for making high-octane gasoline from coal will be supplied by four large boilers, contract for which has been placed with Combustion Engineering-Superheater, Inc., New York. The plant is being built for the South African Coal, Oil and Gas Corporation, Ltd. (SASOL) and will be situated near Johannesburg, South Africa. A pilot plant for producing gasoline from coal has been built in this country by the U. S. Bureau of Mines, but no commercial plants have been projected here as yet. Some commercial plants built in Germany utilized an earlier process.

Expansion Plan Announced At El Dorado Refinery

El Dorado Refining Company has contracted to build one cat cracker, a gas concentration plant less compressors, for complete gas recovery, and to revamp the poly plant to handle the increased charge stock made available by operation of the new cat cracker at El Dorado, Kansas. Refinery Engineering Company will handle construction work at the El Dorado plant, which will total $3,000,000.

The new plant will be able to handle cracking stock from 10,000 bbl of crude oil per day, and will be designed to increase operation to 15,000 bbl daily if desired. It now handles 9000 bbl daily.

When completed, the refinery's consumption of both water and electricity will be doubled. As soon as the catalytic cracker is in operation, the company will begin manufacturing motor fuels of higher octane content, as well as distillate fuels obtainable from crude oil.

The Kansas firm was granted a certificate of necessity for the new project by Federal Defense Production Administration, and authority to buy the critical materials needed by PAD.

Phillips' Plant Sets Record

Employees of Phillips Chemical Company's Cactus plant near Dumas, Texas, have just completed 1,000,000 manhours without a lost-time accident. The safety record, representing a total of 287 consecutive days for the 630 employees, is the second such accomplishment in the plant's history. The previous record was established on November 18, 1949. C. W. Forman is superintendent and R. G. Diserens is safety supervisor of this plant which manufactures anhydrous ammonia and ammonium nitrate.

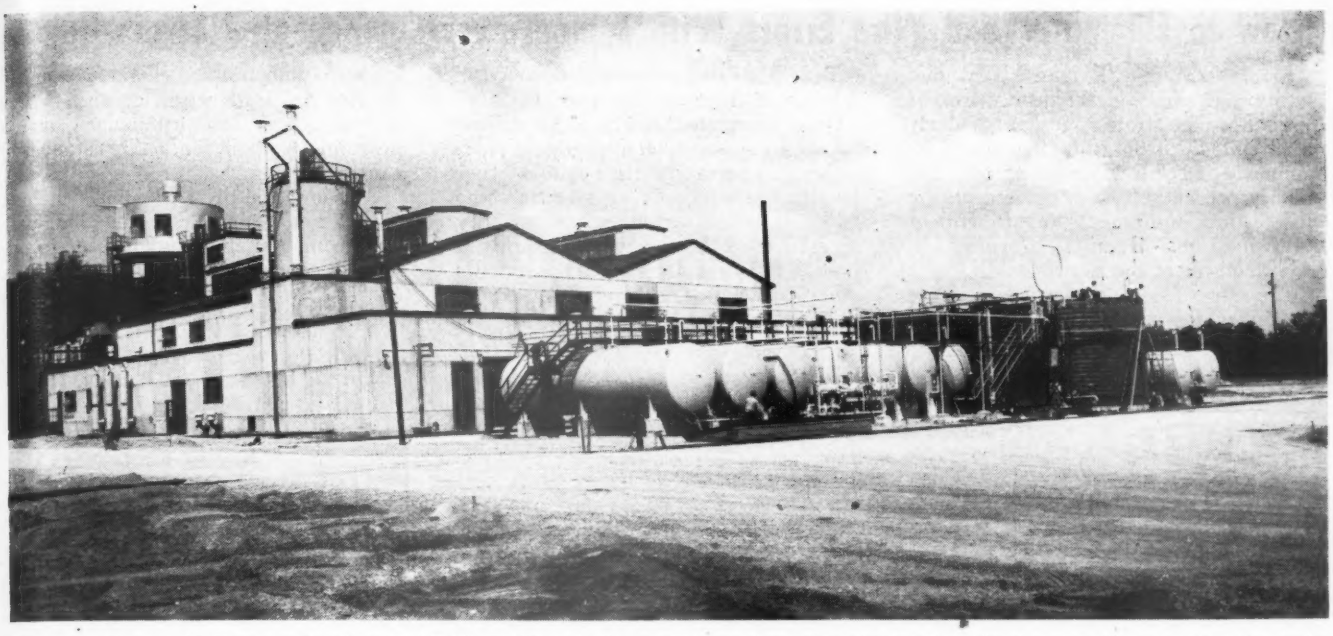
Monsanto Plans New Sulfuric Acid Plant

Monsanto Chemical Company is planning construction of a 250-ton sulfuric acid plant on an 86-acre site at Avon, California, it was announced by Irving C. Smith, general manager of the company's Western Division and executives of Tide Water Associated Oil Company.

The plant, which will utilize waste sludge and hydrogen sulfide piped from the adjacent Tide Water Associated Oil Company refinery, will be owned jointly by Monsanto and Tide Water It is expected to be in operation by the end of 1952.

Most of the sulfuric acid produced by the plant will be piped directly to the Tide Water Associated refinery to be used in the processing of aviation gasoline and other petroleum products. The remainder will be sold to help meet the rapidly expanding demand for acid in the San Francisco Bay area, Smith said.

Designed by Monsanto, the plant will be built by Leonard Construction Company of Chicago and operated as part of Monsanto's Western Division.



American Cyanamid Company's plant in Michigan City, Indiana, where microspheroidal, silica-alumina cracking catalyst is made.

Indiana Cracking Plant Begins Major Expansion

American Cyanamid Company has begun a major expansion of production facilities in its recently constructed micro-spheroidal cracking catalyst plant near Michigan City, Indiana. The expansion will be completed by mid-summer, raising the plant's production rate to a level sufficient for a daily 800,000 bbl of refining capacity.

The company, which pioneered the development in 1945 and commercial production in 1946 of MS catalyst, has been the world's major supplier of the product, producing more than four times as much of the catalyst as any other firm.

Socony to Manufacture Bead Catalyst in Germany

Construction of a plant to manufacture bead catalyst for Thermofor catalytic cracking (TCC) units in Europe is underway at Nienberg, near Hanover, Germany, it was announced by Socony-Vacuum Oil Company, Inc.

The Kali-Chemie Company, one of Germany's leading chemical firms, has been licensed to build and operate the catalyst plant. The plant will be patterned after Socony-Vacuum's original bead catalyst plant located at Paulsboro, New Jersey. Although smaller than the plant at Paulsboro, the German plant has been so designed that its capacity can easily be expanded to meet increasing demands.

The new plant is expected to be in operation by the end of the year and will be the first of its kind on the continent.

One of the European TCC units has already been completed, a 15,000-bbl unit that went on stream last year at the Frontignan, France, refinery of Socony-Vacuum Francaise. Ten TCC units, in addition to the one at Frontignan, are now planned for Europe and one is planned for Morocco. Four of the European TCC units will be in refineries of Socony-Vacuum affiliates, while the remainder will be in refineries of other companies licensed by Socony-Vacuum to use the TCC process.

The new plant of Kali-Chemie will be the first bead catalyst manufacturing plant to be built anywhere outside the United States.

Largest Orthoflow Crackers Underway for Pure Oil

As part of an overall modernization program at Pure Oil's Toledo, Ohio, and Smith's Bluff, Texas, refineries, The M. W. Kellogg Company will design and erect two of the largest Orthoflow Fluid catalytic crackers ever built, it was announced. The one at Smith's Bluff is currently being engineered for a capacity of over 26,000 bbl per day, more than twice as large as any of this new design to date. Throughput of Toledo's new unit will be about 17,000 bbl per day.

Aside from the crackers, Kellogg will also design and erect several other major pieces of equipment at both refineries, as well as revamp certain facilities. At Toledo, new equipment will include a light ends recovery system, a catalytic polymerization unit and sulfur removal equipment. Major revamp will be the alteration of existing equipment into a vacuum feed preparation unit.

For the Smith's Bluff refinery, Kellogg's contract includes, in addition to the Orthoflow cat cracker, a new 20,000-bbl-per-day vacuum feed preparation unit, a cat poly unit similar to Toledo's light ends recovery, sulfur removal equipment, and revamping of thermal cracking facilities. Construction on both jobs is underway.

Davison Begins Building At Lake Charles Site

Construction was begun recently for the plant that The Davison Chemical Corporation of Baltimore, Maryland, will build 10 miles south of Lake Charles on the Calcasieu River in Louisiana. To cost more than $7,000,000, the plant will produce catalyst on a large scale for the petroleum-cracking refineries of the Gulf Coast area, and other chemicals needed by the industries of the section. It will employ about 200 when it goes into production, for which a target date of early next year has been set.

A "task force" from Davison and from the Consolidated Engineering Company of Baltimore, general contractors, has been busy preparing for actual construction.

TCC Unit Planned for Brazil

One of the largest Thermofor catalytic cracking units, with a nominal capacity of 25,000 bbl a day, is under construction for a private corporation in Brazil under license from Socony-Vacuum Oil Company, Inc.

The TCC will be a unit in a refinery being built from the ground up by Refinaria E Exploracao de Petroleo Uniao, S. A., an enterprise capitalized at $16,500,000 and headed by Alberto and Bento Soares Sampaio, brothers with large industrial interests in Brazil. The TCC will be the newest airlift design.

The new refinery will be at Capuava, in the municipality of Santa Andre, 20 miles from Sao Paulo. Crude oil will be fed to it from a pipe line beginning at the seacoast port of Santos, 50 miles away. The pipe line rises 3000 ft six miles from Santos, to reach the plateau on which Sao Paulo is situated. Hydrocarbon Research, Inc., is contractor for the project.

How to Eliminate Lead Wire Errors With Temperature-Compensated Strain Gages

Errors that may be caused by temperature changes in the lead wires of resistance wire strain gages, particularly in circuits incorporating the new self-compensating SR-4 strain gages, are readily preventable, it is pointed out by the testing equipment department of Baldwin - Lima - Hamilton Corporation, manufacturer of the gages.

The use of self-compensating gages eliminates the necessity for "dummy" gages to compensate for temperature changes but renders circuits susceptible to error from temperature changes in the lead wires unless precautions are taken.

The simplest method is to use lead wires of every low electrical resistance or of a low-coefficient wire such as constantan or manganin. If copper wire is used it may require too large a size for convenience, however, or the "dead" resistance of a low coefficient wire such as constantan may be too high for practical use.

To avoid these limitations the so-called "three-wire system" common in resistance thermometry may be used. This is illustrated in Fig 1. Lead wires "d" and "e" are equal and subject to the same temperatures throughout their length. Lead wire "f" may differ from "d" and "e" in resistance and need not be subject to the same temperatures although it is usually run along with the other two wires. This circuit substantially eliminates lead wire errors even when wide resistance variations in the leads are caused by temperature changes.

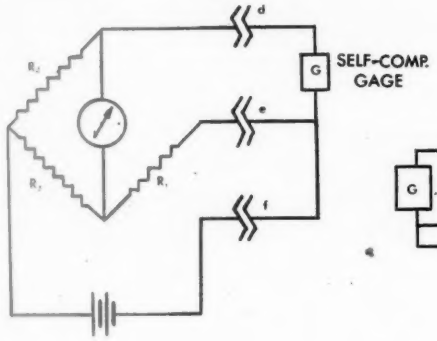


FIG. 1.

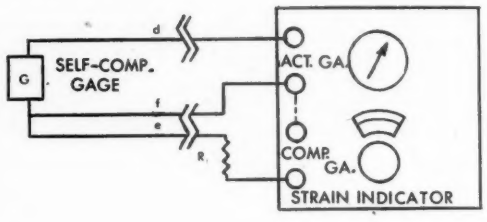


FIG. 2.

Fig. 2 shows a convenient way of using the three-wire system with the Baldwin Type K or Type L portable SR-4 strain indicator. In this circuit the third lead wire "f" is in the detector circuit instead of the battery circuit.

When self-compensated strain gages are used in multiple, a practical arrangement for switching them into the SR-4 strain indicator is shown by Fig. 3. It is assumed that the gages are located sufficiently close together to make negligible the temperature effects on the *difference* in lead wire lengths to the several gages. The switch must have a low and constant contact resistance, of course.

Although the SR-4 20-point switching unit is not designed for the three-wire measuring system, it may be used in this way by connecting the "d" leads to any chosen set of "active gage" terminals (using both terminal screws at each point), tying the correspondingly-numbered "dummy gage" terminals in parallel (again using both terminal screws at each point), and thence to the binding post of the strain indicator.

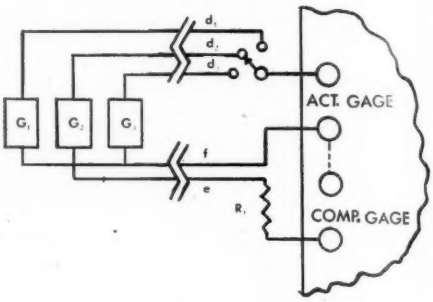


FIG. 3.

On rare occasions a still more precise method utilizing four wires and the Kelvin bridge or modifications of it may be used. Textbooks on electrical measurements describe the method. This method might be useful, for example, when using exceptionally long leads of small diameter, under wide temperature fluctuation, when extreme precision is required.

Gasoline Octane Ratings Reach New Low in 1949-50

Premium and regular price motor gasolines sold at United States filling stations last summer had the lowest octane ratings since the winter of 1949-50, according to the semi-annual survey report released by John J. Forbes, director of the Bureau of Mines, U. S. Department of Interior.

A total of 3427 samples collected from service stations in 205 cities throughout the country, representing the products of 128 large and small companies showed the premium-price motor fuels to have an average octane rating of 89.7 by the research method and 81.7 by the motor method. Regular-price gasolines had an average octane rating of 82.5 by the research method and 77.6 by the motor method. Premium-price gasoline ratings by the research method for the winter of 1950-51 averaged 90.3 and for the summer of 1950 the average was 90.0. The average for the winter of 1949-50 was exactly 89, according to the report.

The following tabulation shows by districts the average research- and motor-method octane numbers of premium-price and regular-price gasolines sold during the summer of 1951.

	Research method		Motor method	
District	Premium price	Regular price	Premium price	Regular price
1. Northeast	91.5	85.9	82.2	79.6
2. Mid-Atlantic Coast	91.3	85.4	82.1	79.5
3. Southeast	90.9	84.5	82.4	79.2
4. Appalachian	90.7	85.0	82.0	79.0
5. Michigan	90.2	84.5	81.8	78.5
6. North Illinois	88.9	82.0	81.6	77.3
7. Central Mississippi	89.4	82.7	81.8	78.3
8. Lower Mississippi	89.8	83.5	82.4	78.8
9. North Plains	88.8	81.4	81.7	77.3
10. Central Plains	88.5	81.8	81.1	77.3
11. South Plains	89.1	81.9	81.5	77.8
12. Southern Texas	89.6	83.0	83.4	80.3
13. South Mountain	88.0	79.1	80.8	75.3
14. North Mountain	89.3	81.3	80.7	75.3
15. Pacific Northwest	90.1	80.5	81.4	75.2
16. Northern California	89.8	80.4	81.2	75.4
17. Southern California	89.6	80.1	80.7	75.1
National average	89.7	82.5	81.7	77.6

ASLE Meeting Set

W. F. Leonard, national secretary, has announced that 33 papers by experts in the technical and semi-technical phases of scientific lubrication and their practical applications are on the program for the 1952 annual meeting of the American Society of Lubrication Engineers. Three question-and-answer symposia will augment the three-day gathering, scheduled for the Statler Hotel, Cleveland, Ohio, April 7, 8, 9.

Industrial Research Meet Set

Professor David B. Hertz has announced that the 3rd annual conference on industrial research will be held at Columbia University, June 9 through June 13, 1952. The conference, which is under the sponsorship of the Columbia Center for Studies of Research Administration, of which Dr. Hertz is the director, has as its theme this year "The Design of Research Operations."

Phillips to Produce Fuels For Air Force Rockets

Phillips Petroleum Company has entered into contracts with the U. S. Air Force, which will lead to the eventual production of solid fuels for rockets and of rocket motors, K. S. Adams, chairman, and Paul Endacott, president, have announced.

Initial activities are being conducted in Bartlesville, however, the major portion of work will be transferred later to another location presently undisclosed.

Phillips is undertaking this project at the request of the U. S. Air Force because this field holds promise of new outlets for chemicals produced from petroleum and natural gas. Phillips was selected for this project after consideration of more than 30 firms, according to the USAF.

Lummus Opens Offices In Houston, Texas

In frank acknowledgment of the great and growing importance of the whole southwestern region in the petroleum, natural gas, and petrochemical industries The Lummus Company, one of the oldest engineering firms in the country, held open house recently at its large new offices in Houston, Texas. This large building becomes a second major center of the far-flung activities of that company and its location in the Gulf Coast region appears to be obviously logical. In fact, in discussing the reasons for transferring much of its work to Houston and expanding its staff correspondingly, company officials point out that of more than $700,000,000 authorized for chemical plants alone, 30 per cent will be and is being spent in the Gulf Coast. "Petroleum-wise," says an announcement of the new development, "The Southwest is king, and never stops producing new wonders."

The new division of the company is self-contained, it is understood. Every step in the design, engineering, construction, etc., of new jobs will be handled at this headquarters, and it will be staffed adequately for every phase of the company's work. The main office of the company is at New York City; in fact the company's oil heater division, and its heat exchanger division are both there.

The new Houston offices are at 2707 Weslayan Road, Houston 5, Texas. In command of the new office is C. E. Barrere, Lummus vice president, widely known to oil and chemical industries throughout the southwest and the entire country.

Petro-Chem Opens Office

In order to accommodate all expanding departments in one location, Petro-Chem Development Company, Inc., widely known engineers and designers of processing furnaces for the petroleum, chemical, and allied industries announce their move to new headquarters in the Chanin Building at 122 E. 42nd Street, New York City.

Standard Indiana Plans North Dakota Refinery

Standard Oil Company (Indiana) has announced its plan to build a new refinery with a capacity of 15,000 bbl per day in the Williston Basin, North Dakota. He added that "the refinery would be designed so that it could be expanded to run at least 30,000 bbl per day as crude production and market demand for products increased."

"A definite site will be selected soon," A. W. Peake, president, said. "Necessary government approvals for the project will be requested in the near future. Engineering work has begun; construction will probably begin in 1953."

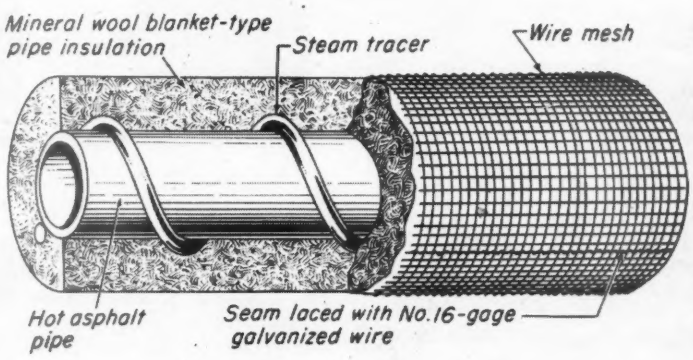
Atlantic Develops New Petroleum Resin Product

The Atlantic Refining Company of Philadelphia has begun to market a new thermoplastic petroleum resin, which it is producing at its Philadelphia refinery. This new product is called S.P. asphalt resin and is produced from petroleum by a solvent process.

Laboratory tests indicate that Atlantic's new petroleum resin can be used in asphalt tile, for internal sizing of Kraft paper, sealing compounds, adhesives, for water-proofing, as a tackifier for synthetic rubbers, and as a plasticizer and extender for rubber compounds, unless light color is important.

SPIRALLY-TRACED PIPE LINE INSULATION

Many plant engineers and contractors have found that blanket-type mineral wool solves such troublesome installation problems as the insulation of asphalt pipe lines heated by spirally-wrapped steam tracers. Blanket-type pipe insulation is flexible and compressible enough for installation over the irregular contours of pipe lines insulated in this manner.



To insulate the spirally-traced pipe in the sketch, each section of blanket-type mineral wool pipe insulation is shaped roughly to fit over the pipe and tracer. The edges of all sections are laced tightly together with 16-gage galvanized wire, with longitudinal seams located on the underside of the pipe. Exposed ends of the lacing wire are bent over into the insulation to eliminate sharp projections.

Available in two-foot lengths, the mineral wool blanket sections are provided commonly with reinforced metal lath or wire mesh on one or both sides. In the sketch, the insulation is secured with wire mesh on the outside and expanded metal lath on the inner surface. The metal lath is applied to the insulation in parallel strips to provide additional flexibility. As the sketch does not show, the metal lath bridges across the tracers—an effect that increases as the distance between tracer coils decreases.

The thickness of insulation depends on the operating conditions of a particular installation. Minimum thicknesses of blanket-type mineral wool pipe insulation recommended by CS117-49* are given in the table for pipe temperatures from 150 F to 1200 F.

Asphalt piping indoors may be finished with two ¼-in.-thick coats of mineral wool insulating cement. The first coat should be allowed to dry thoroughly before the second coat is applied. As a finish, an asphalt-saturated roofing-felt, with seams lapped at least two inches, is wired or banded in place on about 6-in. centers. Asphaltic finishes and canvas jackets, both applied over insulating cement, are also often specified. In outdoor locations piping may be finished with either roofing-felt, asphalt weatherproofing, or a sheet-metal jacket. It is important that both roofing-felt and sheet-metal jackets be lapped downward against the weather. * * *

Mineral Wool Blanket-Type Pipe Insulation
Recommended Minimum Thicknesses**

	Thickness		
Temperature, F	Pipes 2 in to 4 in (inches)	Pipes 4 in to 6 in (inches)	Pipes 6 in & up (inches)
150 to 250	1	1	1
250 to 350	1	1	1
350 to 450	1	1	1½
450 to 550	1	1½	1½
550 to 650	1½	1½	2
650 to 750	1½	2	2
750 to 900	2	2	2½
900 to 1,050	2	2½	3
1,050 to 1,200	2½	3½	4

** For indoor locations; when outdoors, add ½-in.

* *Mineral Wool Insulation Specifications & Standards*, compiled by the Industrial Mineral Wool Institute, New York, N. Y.

—PERSONALS—

William W. Keeler of Bartlesville, Oklahoma, has been named deputy director of the refining division of the Petroleum Administration for Defense. He replaces C. E. Davis as director of the division. Davis will become assistant deputy administrator of PAD in charge of domestic petroleum operations.

Davis will succeed **Alfred P. Frame,** who will remain with PAD during March in the new post of associate deputy administrator and will then resume his position with Cities Service.

Keeler studied chemistry and mechanical engineering at Kansas University. Leaving the university in 1933, he was employed by the Phillips Petroleum Corporation, where he is vice president in charge of refining.

Charles P. Baker, manager of the Socony-Vacuum Oil Company, Inc., refinery in East St. Louis, Illinois, became a member of the company's manufacturing committee recently. The committee coordinates all manufacturing activities at Socony-Vacuum refineries throughout the world.

Oliver C. Johnson, operating superintendent at the refinery, will succeed Baker as manager.

Baker joined Magnolia, Socony-Vacuum affiliate, at Dallas, Texas, in 1934. During World War II he served for three years as chief of the aviation section of the Petroleum Administration for War in Washington with the army rank of major. He is a graduate of Texas A. & M.

J. C. Shaw

J. C. Shaw has recently joined the staff of Purvin and Gertz, consulting engineers, of Dallas, Texas. Shaw holds the MS degree in chemical engineering from Carnegie Institute of Technology. Before joining Purvin and Gertz, he was with the Esso engineering division of the Standard Oil Development Company. Prior to that he was with the technical service division of the Humble Oil and Refining Company. With Purvin and Gertz, he will serve as process consultant for the petroleum refining and natural gasoline industries.

C. P. Govreau, manager of operations in Continental Oil Company's petrochemical plant, has been promoted to assistant manager of the manufacturing department, Houston.

Govreau attended Colorado College at Colorado Springs, and joined Continental in 1927.

Govreau became superintendent of the Baltimore plant in 1950. He was named manager of operations there in June of last year, having advanced through several positions.

Pei Moo Ku, formerly an assistant professor at the Massachusetts Institute of Technology, has joined the staff of the Engines and Lubrication Section of the National Bureau of Standards. Ku specialized in internal combustion engines at the Massachusetts Institute of Technology from 1945 to 1947 and from 1949 until he came to the National Bureau of Standards. He has published a number of papers describing his researches in this field. In 1948 he was professor of aeronautical engineering at Tsinghua University, China.

Ku received a BS in electrical engineering from Chiao-Tung University, Shanghai, China in 1935 and a D.I.C. in aeronautical engineering from the Imperial College, London, England in 1939.

Claude C. Peavy
Houdry

Chalmer G. Kirkbride
Houdry

Daniel L. Pastell
Du Pont

Chalmer G. Kirkbride has been elected as president of the Houdry Process Corporation and **Claude C. Peavy** vice chairman of the board.

Election of **Clarence H. Thayer,** vice president in charge of manufacturing, Sun Oil Company, as a member of the Houdry Board was announced at the same time.

Kirkbride has been vice president in charge of research and development and Dr. Peavy vice president in charge of engineering and sales of the Houdry Process Corporation. Members of the same graduating class at the University of Michigan in 1930, both joined Houdry in 1946.

Dr. Peavy joined Houdry as chief of the process design division in 1946 and a year later was appointed chief engineer. He has been vice president in charge of engineering and sales since 1948.

Jack C. Dart recently was named manager of research and development, Houdry Process Corporation, with **Dr. Alex G. Oblad** as associate manager. **Dr. G. Alexander Mills** is the new director of research, and **Theodore A. Burtis,** director of development.

Dart has been director of the Houdry development laboratory since 1947. Before joining Houdry, he was with Standard Oil Development, Magnolia Petroleum, Pan American Refining, and Universal Oil Products. He received his BS and MS degrees at the University of Michigan.

Dr. Oblad also has been with Houdry since 1947. Prior to that he held research posts with Standard Indiana, Magnolia Petroleum, and the Texas State Research Foundation. He is a graduate of the University of Utah, and received his Ph.D. at Purdue. Dr. Mills joined Houdry in 1940, having served as a member of the chemistry department at Dartmouth College. He became assistant director of research in 1947. He is a graduate of the University of Saskatchewan and was awarded a Ph.D. at Columbia.

Burtis has been chief of the economics section of Houdry's research and development department since 1947. He joined Houdry after previous engineering experience with Magnolia and Owens-Corning Fiber Glass Company. He is a graduate of Carnegie Institute of Technology and A. and M. College of Texas.

Daniel L. Pastell of the Du Pont Company's petroleum laboratory staff has been awarded the 1950 Horning Memorial Award by the Society of Automotive Engineers. Presentation was made at the meeting of the Society of Automotive Engineers in Detroit, Michigan. It is given annually to the author of the best paper on the adaptation of fuels to internal combustion engines. Pastell's paper, *Precombustion Reactions in a Motored Engine,* was presented at the SAE summer meeting, held at the French Lick Spring Hotel, French Lick, Indiana, June 4-9, 1950. Pastell is a graduate of University of Washington.

R. M. Heine

R. M. (Bob) Heine has joined Cosden Petroleum Corporation as an engineer. Heine has spent several years in the asphalt industry in engineering, chemistry, research and development, promotion, and construction. He is a graduate of St. John's College, Annapolis, Maryland. He received his early training in bituminous chemistry in the laboratories of Baltimore, Maryland, while attending college, and pioneered roads in Arkansas for two years between Jonesboro and Lake City, while working for Pittsburgh Testing Laboratory as engineer and chemist. He was then employed by Chicago Paving Laboratory, Inc., and spent 15 years as vice president, director of research and consultant for L. R. MacKenzie, Inc., Tulsa, Oklahoma. Before joining Cosden he was asphalt superintendent of Collins Construction Company, Austin, Texas.

E. R. Laminack, training director at the Beaumont, Texas, refinery of Magnolia Petroleum Company, an affiliate of Socony-Vacuum Oil Company, Inc., has been appointed manager of training activities for Socony-Vacuum.

The appointment, effective March 1, will bring Laminack to Socony-Vacuum headquarters in New York, where his duties will cover training in all of the company's operations.

Laminack has been a member of the industrial relations staff of Magnolia's refining division since October, 1944. Prior to that he had held various positions at the Beaumont refinery, among them stillman, shift foreman and night superintendent.

Roy O. Campbell has been appointed chief chemist of The British American Oil Company Limited. He is a graduate of the University of Missouri in chemical engineering. He joined B-A in 1931 as resident chemist at Toronto refinery and has held a number of important positions in the company. Since 1949 Campbell has been technical assistant in the marketing department.

Dr. Louis Koenig, noted industrial research chemist and executive, has been named an associate director of Southwest Research Institute. A native of New York State, Dr. Koenig, who was awarded the Doctor of Philosophy degree by New York University, came to Southwest from Stanford Research Institute of Palto Alto, California.

Robert T. Haslam has been elected a member of the board of directors of the Dewey and Almy Chemical Company, Bradley Dewey, president, announced. Haslam, a widely known chemical and marketing executive, is a former vice president and director of Standard Oil Company (New Jersey).

He is president of the United States Pipe Line Company, a director of W. R. Grace and Company of New York; a director and member of the executive committee of Ethyl Corporation, and a director of American Gas & Electric Company, and Worthington Pump and Machinery Corporation.

Prior to joining Standard Oil in 1927, Mr. Haslam was professor of chemical engineering at Massachusetts Institute of Technology and is now a member of the corporation of MIT.

Dr. Frederic L. Matthews has been named technical director of the research section of Socony-Vacuum Oil Company's laboratories at Paulsboro, New Jersey. He has been director of research of the Merrimac Division of Monsanto Chemical Company, Boston, since 1948.

Dr. Matthews has been associated with Monsanto since 1939 when he entered the research department of the organic division. He was made associate director of research in the Merrimac division in 1947 and director the following year. He was graduated from Columbia University.

Dr. George E. Hinds, 43, has been appointed assistant to the manager of Continental Oil Company's petrochemical department, with headquarters in Houston. Dr. Hinds was until recently director of technical coordination for Sharples Chemicals, Inc., at Philadelphia, Pennsylvania. He joined the chemical firm in 1936, following receipt of his doctorate in organic chemistry from Purdue University, Lafayette, Indiana, where he was awarded his master's degree in 1932.

L. J. Frodin of the Whiting, Indiana, refinery of Standard Oil Company (Indiana) has been transferred to the company's general offices in Chicago, Illinois, according to an announcement by Dr. M. G. Paulus, vice president in charge of manufacturing.

Frodin will be supervisor of the personnel section in the manufacturing department. He was formerly office manager at the Whiting refinery. He joined Standard in 1921.

Harold M. Trimble, associate director of research in the research and development department, Phillips Petroleum Company, has been reappointed to the subcommittee on aircraft fuels of the National Advisory Committee for Aeronautics, by Jerome C. Hunsaker, chairman. He has been an employee of Phillips since 1929. His entire professional career has been confined to fuels and lubricants evaluation studies.

Keith E. Rumbel

Keith E. Rumbel has joined the staff of chemical engineers at Atlantic Research Corporation, Alexandria, Virginia. Previous to his appointment at Atlantic Research, Rumbel held the post of assistant professor at the Massachusetts Institute of Technology, and was also director of the MIT school of chemical engineering practice, Buffalo Station. He holds a BS degree from Rice Institute and an MS from MIT.

J. C. Bailie, assistant chief chemist at the Whiting, Indiana, research laboratories of Standard Oil (Indiana), has been promoted to chief chemist at the company's Neodesha, Kansas, refinery, it was announced by J. K. Roberts, general manager of research and development.

W. J. Tancig, group leader, is advanced to assistant chief chemist at Standard's Whiting refinery.

Dr. Bailie, who has been assistant chief chemist at Whiting since 1947, succeeds **H. V. Knight,** transferred to the manufacturing department at Neodesha. Dr. Bailie was graduated from the University of Illinois and received his master's degree in chemistry from Kansas State Teachers College.

Tancig joined Standard in 1939 as a chemist. He holds bachelor's and master's degrees in science from the University of Chicago.

Three other Standard research men have been promoted to the rank of group leader. They are **J. A. Anderson, D. S. Gray,** and **V. A. Smith.** All three are at the Whiting research laboratory.

Dr. Anderson has been a research chemist with Standard since 1928. He was graduated from the University of Illinois in 1922 as Bachelor of Science and received his Ph.D. from Yale.

Gray joined Standard in 1949 as an automotive engineer after five years with Armour Research foundation. He was graduated from Illinois Institute of Technology.

Smith has been a chemist with Standard since 1947. He was graduated from Montana State college in 1947.

A. H. Fox, group leader, has been promoted to research associate in the automotive research division of Standard at Whiting. Fox began his work with Standard as automotive engineer in 1937, and was advanced to group leader in 1944. He was graduated from Purdue University.

AN OLDTIME RECIPE FOR LONG-LIVED PIPE LINES

A recipe that waterworks and gas distribution engineers have used for over a century is: *specify cast iron pipe.* Refinery engineers have used it, too—with good success—for run-down, water and gasoline lines—for fire protection systems—salt water disposal—condenser and cooling coils.

No other pipe, at reasonable first cost, offers comparable resistance to both interior and exterior corrosion. No other pipe, in its price range, is as economical in the end Available with bell-and-spigot, plain end and flanged, or with standardized mechanical joints. Cast Iron Pipe Research Association, Thomas F. Wolfe, Engineer, 1015 Peoples Gas Bldg., Chicago 3, Illinois

CAST IRON PIPE
FOR LONG LIFE AND ECONOMY

Socony to Produce Benzonitrile Commercially

Commercial quantities of benzonitrile, a chemical with a wide variety of potential uses, are again available, it has been announced by Socony-Vacuum Oil Company, Inc. The chemical, a colorless liquid with an almond-like odor, is produced exclusively at Socony-Vacuum's Paulsboro, New Jersey, refinery through a unique process involving the catalytic reaction of petroleum raw materials with ammonia. It has been manufactured by the company for some time, but production has been limited because of a shortage of the basic raw materials.

According to Henry K. Chapin, Socony-Vacuum's manager of chemical products, the market for benzonitrile has yet to be well defined as the chemical never before has been available in large quantities.

Mexico Plans to Raise Sulfur Export Rate

Mexico has reported that she plans to increase her output of sulfur from 1800 to 40,000 tons this year. Nearly all Mexico's sulfur is exported as she has no sulfuric acid industry of her own. New Mexican refineries are said to account for the increase. Recently 600 tons were sent to Canada in return for a promise to increase newsprint shipments. The government oil company also reported that it hopes to increase oil exports this year from 23,000,000 to 28,000,000 bbl.

Character of NGAA Convention Changed

Due in the increased registration in recent years at annual conventions of the Natural Gasoline Association of America, the usual routine of sessions is to be radically changed, according to NGAA Secretary Willliam F. Lowe, Tulsa, Oklahoma. The 1952 convention is scheduled in the Rice Hotel, Houston, April 30, May 1 and 2.

NGAA president, John F. Lynch, president of La Gloria Corporation, Corpus Christi, stated there were several reasons why continuance of the usual series of general sessions was impractical. "Operations within the industry are now so varied and personnel so divided into groups of specialists that sessions must also be divided to appeal to special groups" he said. "Too, it is difficult to have all the papers usually presented at a general session of interest to the large group of men who attend. Accordingly, morning periods of the NGAA convention will consist of forums on specific subjects, each held in a separate room on the same floor of the hotel and running simultaneously."

Frank Matheny, Sid Richardson Gasoline Company, Fort Worth, is chairman of the program committee and has announced that plans for the forums are nearly complete. Separate forums are scheduled on each of the following subjects: "Gathering Systems—High and Low Pressure", "Safety and Personnel", "Traffic", "Fractional Analysis", "Corrosion". "Absorption Oils and Efficiency,". "Short Cuts in Design Calculations" and "Liquefied Petroleum Gases." Most of these forums will have but two papers.

DPA Tax Certificates Issued Total 573

Between December 22 and January 18, 573 new or expanded defense facilities received certificates of necessity for accelerated tax amortization. The Defense Production Administration has reported that of the 573 certificates, 272 are for facilities involving proposed expenditures of $100,000 or less.

Recently announced certificates bring to 6016 the number of new or expanded facilities for which speeded up tax amortization has been approved. The grand total since the date of the first certificate December 10, 1950, has now passed $12,500 million. Recent grants include:

Name of company Location of facilities	Product or service	Amount applied for	Amount eligible	Percentage certified
General Petroleum Corp Worland, Wyoming	sulfur process	$4,220,000	$1,259,000	70
			$2,433,000	65
			$ 528,000	40
South-Tex Co p. Nueces County, Texas	gasoline, propane, butane	$1,081,100	$ 920,200	65
			$ 160,900	40
Universal Oil Products Mooringsport, La.	synthetic crack catalyst	$2,000,000	$1,555,100	75
			$ 384,300	50
			$ 60,600	15
Ethyl Corporation Baton Rouge, La.	tetraethyl lead	$ 150,000	$ 150,000	65

Refrigerated Extraction Plant Begins Operation

Record throughput designed for ethane extraction from pipe line stream of Tennessee Gas Transmission Company

J. J. KING* AND R. V. MERTZ*

THE largest gas capacity ever designed for a plant processing natural gas is incorporated in a plant recently completed and put into operation by Tennessee Gas Transmission Company near Greensburg, Kentucky. The plant receives natural gas from the company's pipe line, removes ethane and heavier hydrocarbons and returns the stripped gas to the pipe line. The design capacity of the plant is 750,000,000 cu ft per day. Separation of the ethane and heavier hydrocarbons from the gas stream is accomplished by using refrigeration only. Refrigeration capacity required is equivalent to a 12,000 ton-per-day ice making plant.

Under normal operating conditions the entire gas stream through the plant will be chilled to minus 96 F. Liquids previously found to be objectionable to Tennessee's gas customers will be condensed and delivered to a chemical company, which will convert them to LPG, natural gasoline, and ethane. Total liquid production will eventually amount to 380,000 gal per day when the operation has been stabilized and the design quantity of gas is processed.

A unique heat exchanger arrangement is used in order to accommodate the large volume of gas processed. The gas stream from the pipe line is split into four parallel streams through the plant. Heat exchangers 42 in. in diameter are assembled end to end to form the four heat exchanger trains. The long exchanger train arrangement was chosen to simplify the piping and to provide a straight-through path for the gas. This arrangement makes for low pressure drop in addition to the simplified piping arrangement.

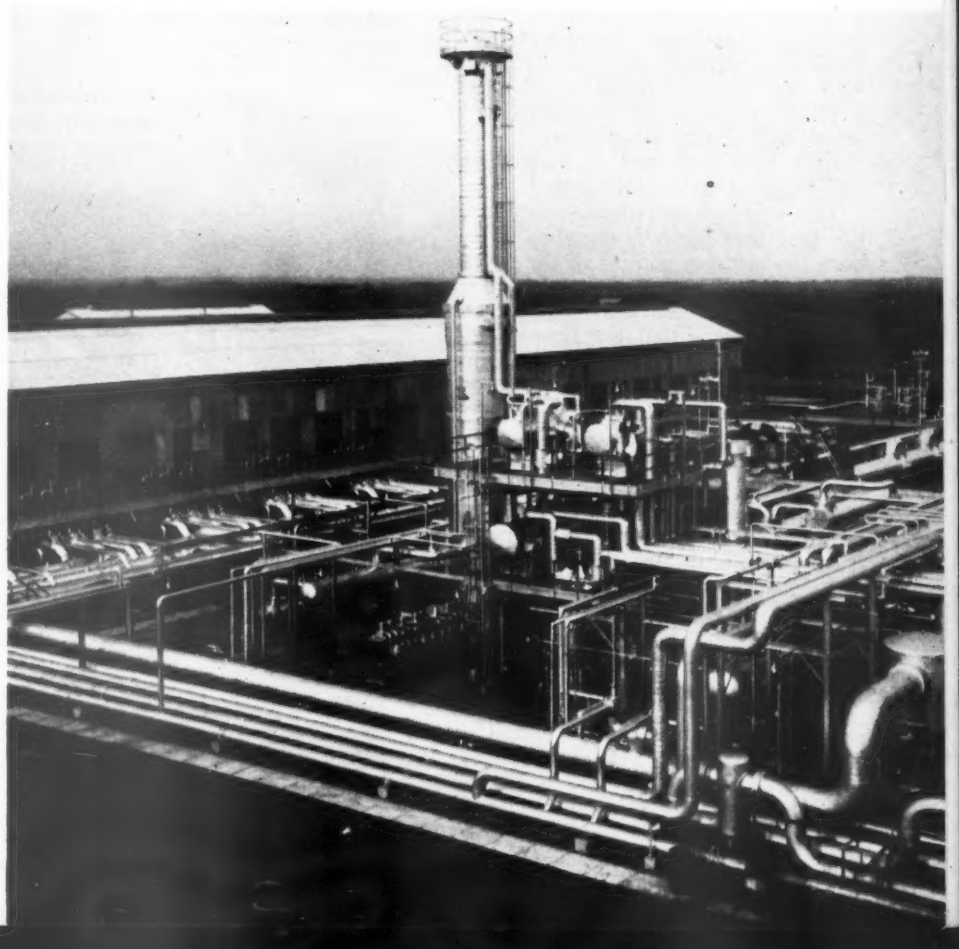
Construction of the plant was begun in May, 1950. The site near Greensburg, Kentucky, was chosen because of the convenience to Tennessee's main transmission line and the chemical plant that will process the extracted liquid stream. Tennessee's extraction plant is connected with the chemical plant by a 60-mile long, 8-in. pipe line.

Plant Processing

The process utilized to recover the hydrocarbons from the pipe line gas consists basically of only two major operations. The first operation is the separation of the desired hydrocarbons from the feed gas stream. This is accomplished by cooling the gas stream until a sufficient quantity of the hydrocarbons condense. The second operation involves processing the condensed hydrocarbon liquid to remove unwanted methane and to control the amount of ethane present in the product stream. This is accomplished by flashing hydrocarbon liquid twice at successively lower pressures and then fractionating it.

Gas entering the plant from the pipe line must be dried before being subjected to low temperature processing. Eight dehydrators operating on stream in parallel are required to handle the total feed gas flow. A flow controller is provided on the inlet piping to each dehydrator to distribute the flow evenly among dehydrators and to control the total plant throughput.

Ten dehydrators are provided in order to have eight effective units on stream at all times. Each dehydrator contains a 20-ft deep bed of alumina granules through which the wet gas passes during the drying cycle. Water absorbed during this cycle is removed by taking each dehydrator off stream periodically and passing hot gas through the alumina bed. The reactivated dehydrator is then cooled by passing a cool gas stream through the bed and is ready for return to service. The 10 dehydrators have been designed to permit a continuous operating schedule with



Refrigeration area of the Tennessee Gas Transmission Company liquefiable hydrocarbons extraction plant near Greensburg, Kentucky. Deethanizer tower is in center, and compressor building in background.

*Vice president and compressor superintendent, respectively, Tennessee Gas Transmission Company, Houston, Texas.

eight units always in on-stream condition while the other two are being reactivated and cooled.

Dry gas from the dehydrators at 70 F is cooled to minus 104 F at approximately 535-psi gage. Under these conditions about 5.5 mol per cent of the gas condenses. The condensed hydrocarbon liquid is separated and the residual gas, after heat exchange, is compressed to 590-psi gage and returned to the pipe line.

Four parallel trains of heat exchangers are required for feed gas cooling when the plant is operating at design capacity. Dehydrator exit piping is manifolded in such a way that each exchanger train receives gas from one pair of on-stream dehydrators. Thus, the gas flow through each train is controlled by the setting of the flow controllers upstream of the dehydrators.

In each train these exchangers are bolted end to end, providing straight-through flow for the feed gas on the tube side. The first four shells exchange heat between the incoming warm feed gas and the cold residue gas stream from which the condensed hydrocarbon liquid has been removed. Thus, these exchangers serve the dual purpose of cooling the feed and recovering refrigeration from the residue gas. The fifth shell in each train employs ethane refrigerant at minus 96 F to provide the net refrigerating effect required to remove latent heat from the liquid product. The last shell in line recovers refrigeration by evaporating excess light hydrocarbons, principally methane, which were condensed in the high pressure separator.

The hydrocarbon liquid collected in the liquid separator is flashed to a lower pressure. In passing through the expansion valve, a portion of the liquid is vaporized and the stream is cooled by self-refrigeration. The vapor-liquid stream is warmed by heat exchange with the feed, the liquid is separated and flows to the second feed flash operation while the disengaged vapor, after further heat exchange, is compressed and returned to the pipe line.

This series of operations, constituting the first feed flash, is designed to reduce the methane content of the hydrocarbon liquid condensed from the feed gas. The liquid is flashed and heated under conditions that are favorable to the preferential vaporization of methane and that also make possible the recovery of valuable low temperature refrigeration.

Liquid from the first flash exchanger is flashed to a lower pressure. The residual liquid from the flash is separated from the vapor and is forwarded to the fractionator while the vapor, after heat exchange, is used for plant fuel. Although the first flash operation removed a substantial amount of methane from the liquid stream, a further reduction in methane content is necessary.

In the second flash, a methane-rich vapor is removed, leaving a liquid of less than half the original methane content. In principle, the second flash operation is quite similar to the first, but differs in that the addition of heat is not required to obtain the desired degree of vaporization.

In the second flash operation, first flash liquid at minus 112 F and 145-psi gage flows into a common product accumulator, which is operated at 40-psi gage. In passing through the level control valve the pressure is reduced from 145-psi gage to 40-psi gage, about 15 mol per cent of the liquid is vaporized and the stream self-refrigerates to minus 121 F.

The minus 121 F vapor-liquid mixture is separated in a product accumulator. The liquid is then pumped to the de-ethanizer, while the minus 121 F vapor is warmed to 84 F by heat exchange with an ethane refrigerant stream and then flows into the plant fuel system.

Liquid from the product accumulator is pumped through heat exchanges to the de-ethanizer. The tower produces a bottom liquid product of desired specifications, which is cooled and then flows from the plant to the product line. Tower overhead vapor, after heat exchange, is compressed for return to the gas pipe line.

Process Gas Compression

The residue gas stream, the first flash vapor stream, and the de-ethanizer overhead must be compressed for return to the pipe line. In addition the dehydrator reactivating and cooling gas requires recompressing in order to get it back into the feed gas to the plant. Six 1760-hp gas engine driven reciprocating compressors are used for process gas compression. Each of these machines is multi-purpose in that it is designed to handle more than one of the services mentioned above. Four of the machines are each equipped with four compression cylinders. Two of these cylinders are designed for residue gas service, while the remaining two handle the first and second stage flash gas services respectively. The other two machines also have four compressor cylinders each. In the latter case the first two cylinders are designed for residue gas compression, the third for first stage flash gas, and the fourth for reactivating gas.

The speed of each of the compressors is controlled, from a common source to maintain the desired plant feed gas rate. The speed control governor on each of the machines is actuated by differential pressure controller. This instrument maintains a fixed pressure drop in the feed gas stream across the feed gas flow controllers and dehydrators by controlling the rate at which residue gas is withdrawn from the process.

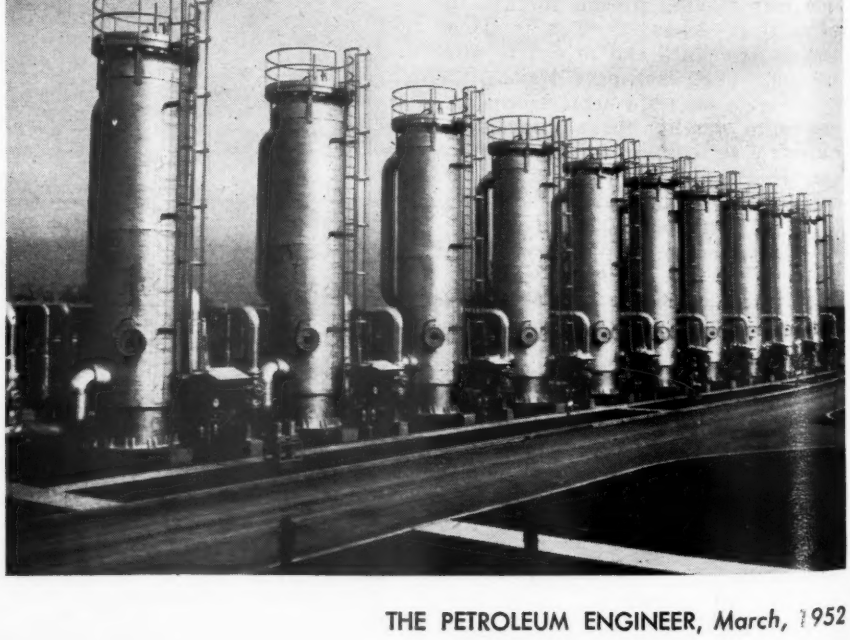
In order to obtain the desired compression characteristics for the flash gas and reactivating gas services, clearance pockets are provided in all compressor cylinders. These clearance pockets must be manually adjusted to balance compression loads between the three services and insure the desired compression ratio and capacity for each service.

Refrigeration

A conventional ethane-propane cascade-type refrigeration system is employed in this plant to provide low level ethane refrigeration at minus 96 F and intermediate level propane refrigeration at minus 15 F. Under this system, ethane refrigerant is circulated in a closed system and condensed with propane refrigerant, which also circulates in a closed system, and, in turn, is condensed with cooling water.

In the ethane refrigeration cycle, liquid ethane flows to the feed gas cool-

Battery of 10 solid-type dehydration towers, part of the extraction plant. Dehydrators reduce dew point of main gas stream to — 100 F.



ers (and to the de-ethanizer condensers). Exchangers utilize refrigeration available in low temperature process streams to cool the liquid refrigerant and to reduce the amount of liquid required for a given refrigeration load.

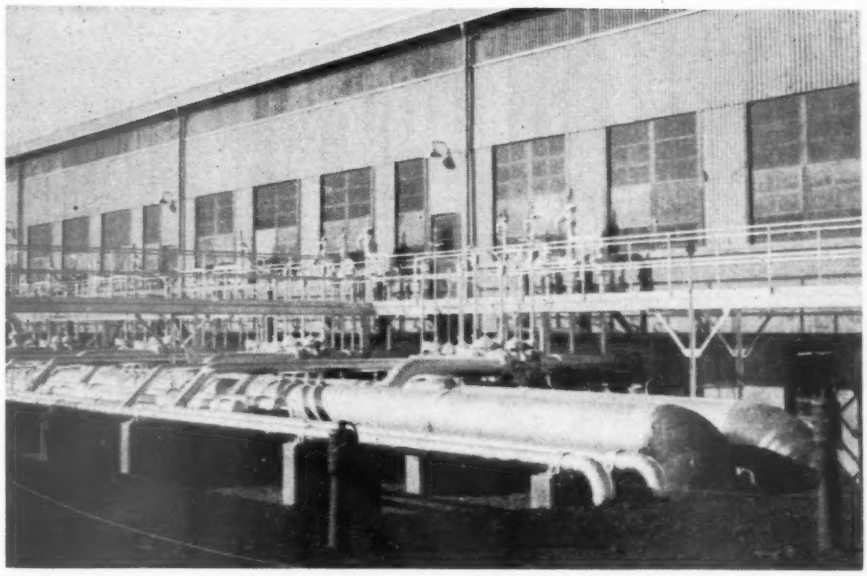
The ethane is vaporized at 19.7-psi gage and minus 96 F in the feed gas coolers and the vapor flows through an exchanger to the compressor suction. The ethane liquid-vapor exchanger serves a dual purpose in that it recovers valuable refrigeration from the low temperature vapor stream and at the same time warms the vapor sufficiently to permit safe operation of the first stage compressor cylinders. By warming the vapor to minus 15 F any entrained liquid droplets will be vaporized before entering the compressor. Low temperature alarms are provided in the ethane compressor suction line. These alarms flash warning signal lights in the control house and compressor house if the vapor temperature drops to minus 25 F and automatically shut down the compressors if the temperature drops to minus 50 F.

The ethane vapor is compressed through two stages from 14.8-psi gage to 200-psi gage. Suction pressure is held constant by controlling the compressor speed through the action of a pressure controller. Compressed vapor is aftercooled to 94 F and partially condensed in exchangers. These exchangers utilize refrigeration available in low temperature process streams to reduce the load on the propane-cooled ethane condensers. Partially condensed ethane is totally condensed at minus 5 F in the main ethane condensers and returned to the storage tank thus completing the ethane refrigeration cycle.

In the propane refrigeration cycle, liquid propane flows into the interstage flash drum. As the liquid enters this drum, under level control, its pressure is reduced from about 190-psi gage to 63-psi gage, a portion of the liquid is vaporized and the stream is self-refrigerated to 40 F. The refrigeration effect of interstate flash operation improves the efficiency of the propane refrigeration system by reducing the amount of propane that must be circulated through the low pressure side of the system for a given refrigeration load.

Vapor from the interstage flash drum is taken directly into the second stage suction of the propane compressors. In order to avoid the possibility of liquid carry-over into the compressors, the flash drum is provided with a metal mesh separator element that will remove entrained droplets and with high level alarm controllers that guard against liquid overflow. These instruments actuate signal lights in the control room and compressor house if the liquid level rises above normal operating limits and shut down the compressors if the level continues to rise.

Propane liquid from the interstage flash drum flows into the shell side of ethane condensers, the de-ethanizer condenser, and the make-up tower condenser. Individual level controllers mounted on the shell of each of these exchangers govern the rate at which the propane is admitted. Propane vaporized in these units at minus 15 F and 13.3-psi gage flows through the propane suction separator into the low stage compressor cylinders. The separator drum is sized to remove entrained liquid droplets from the vapor stream and contains a heating coil to vaporize any liquid collected. Hot propane vapor from the compressor second stage discharge is used as the heating medium in this coil. High level alarm controllers actuate signal lights in the control and compressor houses if the liquid level rises to a predetermined point and shut down the refrigerant compressors if the separator liquid level continues to rise.



Compressor headers for ethane and propane refrigeration compressors—part of the liquefiable hydrocarbons extraction plant situated on the TGT long-line natural gas transmission system near Gabe, Kentucky.

Propane vapor from the suction separator is compressed from 11.8-psi gage to 60.9-psi gage in the first stage compressor cylinders. Vapor from the interstage flash drum joins this stream in the interstage header and the combined streams are compressed to 200-psi gage in the second stage. The high pressure vapor is totally condensed in water cooled propane condensers and then flows into the propane storage drum, thus completing the propane refrigeration cycle.

Seven identical 1760-hp reciprocating compressors are provided for refrigerant service. Each machine is equipped with four compressor cylinders, two of which handle the first and second stage propane service while the other two are designed for first and second stage ethane compression. As mentioned previously, compressor speed is automatically varied to maintain a constant ethane suction pressure. In order to balance ethane and propane compression loads and to obtain the desired propane suction conditions, clearance pockets are provided on all compression cylinders.

Separators are provided downstream of the compressors in both the ethane and propane systems. These units are designed to remove lube oil that the refrigerant streams may pick up in passing through compressor cylinders.

A refrigerant dehydrator is provided for the common use of the two refrigeration systems. This unit contains alumina desiccant for absorbing water from the refrigerants and incorporates all necessary equipment and controls for reactivating the desiccant and disposing of the absorbed water.

Refrigerant Make-up

Facilities have been incorporated in the plant to produce substantially pure ethane and propane for the refrigeration systems. It is estimated that approximately 1 psi per bhp per month of refrigerant will be required to make-up for system losses. On this basis the quantity of ethane required as make-up per month will be about 1500 gal and the quantity of propane about 1000 gal.

When the plant is in normal operation the refrigerant make-up tower is operated periodically as a batch still to produce ethane and propane make-up for the refrigeration systems. The tower is 24 in. in diameter and contains 15 ft of Berl saddles as packing. It is equipped with a steam-heated reboiler and a propane-refrigerated reflux condenser. A differential pressure controller maintains a constant pressure drop across the packed section to prevent flooding by acting in conjunction with a flow controller to control reboiler heat input. Feed for the make-up tower is taken either from the de-ethanizer reflux or bottom product, from the de-ethanizer reflux when ethane is to be made and from the bottom product when propane is to be made.

Fire Protection

The fire protection system consists of two underwriters-approved fire pumps taking suction from the storage tank gravity feed line and discharging to an underground grid system of piping with hydrants and small hose cabinets at strategic locations in the process and residence areas.

Each fire pump is rated at 500 gal per minute with a discharge head of 100-psi gage. One pump is electric motor drive and one gasoline engine drive. Both pumps are manually operated from the water treating building and the grid system is under pressure only when the pumps are in operation.

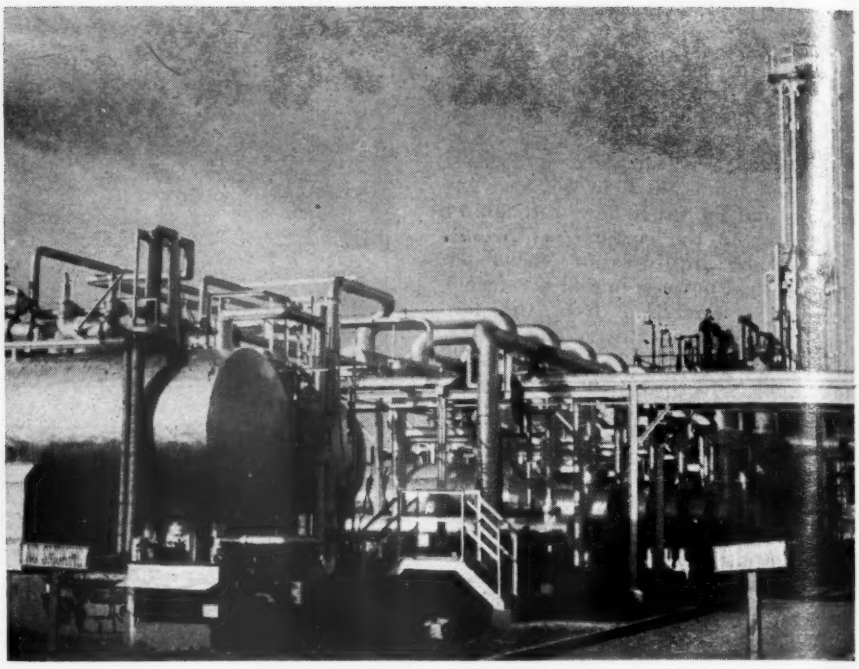
Steam and Condensate

Steam is supplied by a package type steam generating unit. This unit consists of boiler, combustion equipment, mechanical forced draft, and boiler feed water return system complete with necessary fittings and controls. The natural-gas-fired, water-tube type boiler has a rated capacity of 12,000 lb per hour of steam from and at 212 F. Its maximum pressure rating is 160-psi gage but it will normally operate at or below 100-psi gage.

Condensate is returned under steam pressure from the steam traps to the vented condensate receiver and is pumped into the boiler by the boiler feed pumps. Treated water is used for boiler feed make-up.

Fuel Gas

Process vent gas streams constitute the normal source of plant fuel. The compressor fuel system operates at 25-psi gage and receives most of its fuel from the second flash vapor stream. This stream is insufficient to meet the total compressor fuel demand, however, so a small portion of the first flash vapor stream is used to make up the deficit. A pressure controller allows enough of the 135-psi gage first flash vapor to bleed into the compressor fuel system to maintain the desired 25-psi gage pressure in that system.



Refrigerant storage and refrigerant heat exchangers with de-ethanizer in background; part of the extraction plant.

The auxiliary system normally receives all its fuel from the first flash vapor stream. The 135-psi gage gas is taken from the flash vapor compressors' first stage suction header, throttled through a pressure controller, and distributed through the system at 25-psi gage. Gas is piped at 25-psi gage to the reactivating gas furnace, employee's cottages, calorimeter building, the office building, warehouse, garage, and water treating building. A second pressure regulator reduces the pressure to 1-psi gage for use in the electric generators, and the auxiliary building heating system. An emergency and make-up fuel supply is provided from the feed gas to the plant through a pressure controller that reduces the pressure from the main line pressure to 25-psi gage.

Line of silvery objects above might be taken for a formation of mechanical men from Mars. It is a row of exhausts at the compressor house of the TGT plant.

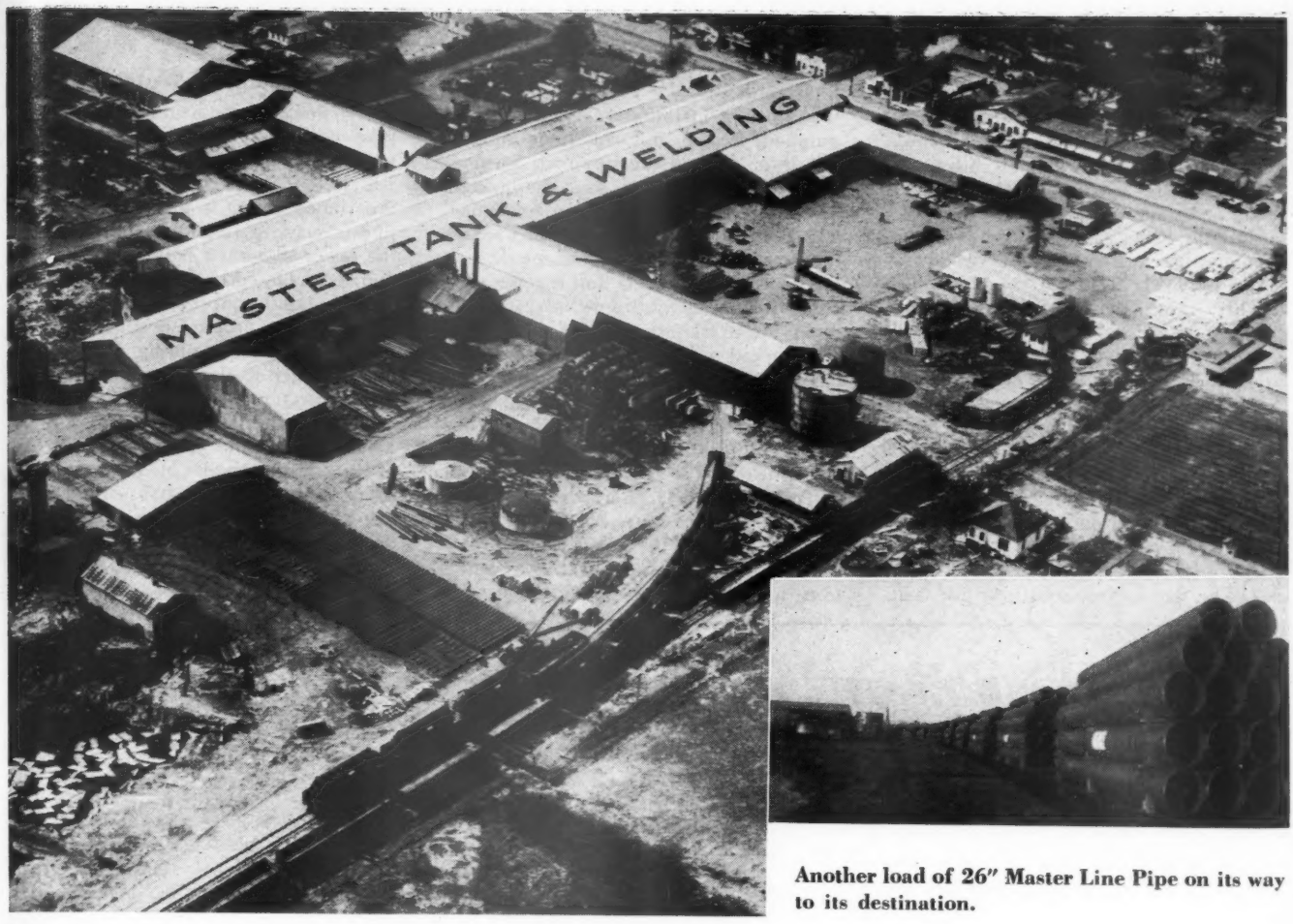
Water Supply and Treatment

Water is drawn from the Green River through twin intake caissons and is pumped to a 300,000-gal capacity storage tank near the plant site by means of two vertical turbine type deep well pumps.

Each pump has a capacity of 200 gal per minute at a discharge pressure of 140-psi gage. One pump has an electric motor drive, the other a combination electric motor and gasoline engine drive with disengaging clutch. It is intended that one pump will carry the normal load although the pumps may be run in parallel if required. Pump operation on electric motors is by means of an altitude controller actuated by the head of water in the tank.

The gasoline pump, for use when electric power is not available, is manually controlled.

From the storage tank water flows by



Another load of 26" Master Line Pipe on its way to its destination.

36 ACRES of Line Pipe Production

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Line Pipe Division

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gravity to the water treating building where it is treated for boiler make-up, jacket cooling, and building service.

The water treating plant is designed for a continuous rated net output of 30 gal per minute with capacity to handle 60 gal per minute when all filter and softener units are in operation. Treatment is accomplished as follows: (1) Coagulant feed; (2) filtration; (3) sodium zeolite softening, and (4) hypochlorination.

The water to be treated is first pumped to an elevated storage tank from which it flows by gravity to the inlet lines of two 4-ft 6-in. diameter, Apexier-lined, sand and gravel pressure filters for removal of suspended material. The pressure filters are arranged to operate in parallel with all operations associated with backwashing which is controlled by a multiport valve.

As an aid to filtration, a coagulant is fed in the form of a preformed alum floc. The floc is prepared in a 2-ft 6-in. diameter Heresite-lined tank provided with motor-driven agitator for effective mixing and is then delivered to the filter units.

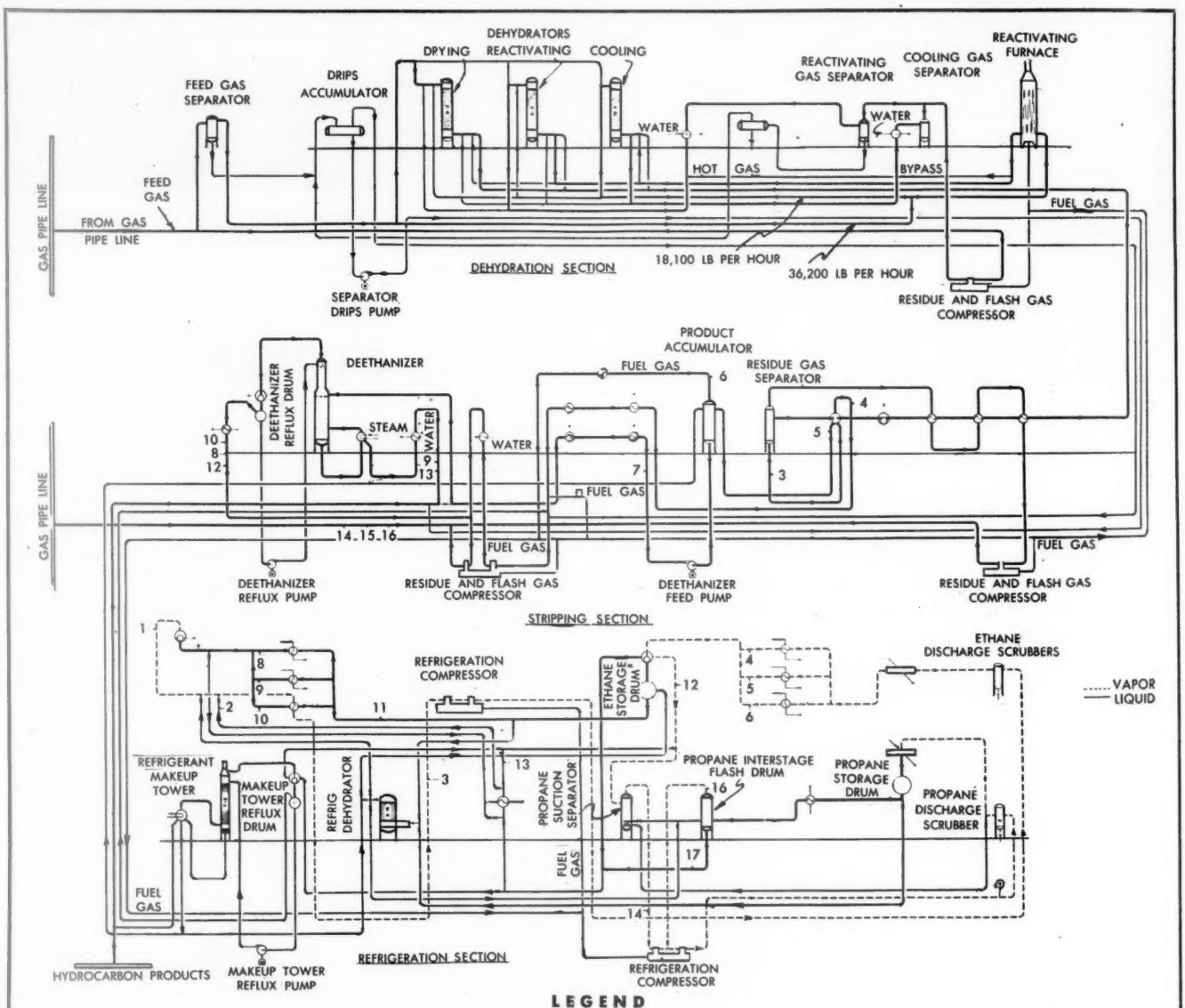
Following filtration the water is next pumped to the influent lines of two 2-ft 6-in. diam, Heresite-lined, softener units where calcium and magnesium hardness is removed by ion exchange. The softeners are arranged to operate in parallel with all operations associated with backwashing and regeneration controlled by a multiport valve. Equipment for preparation of brine regenerant consists of one 2-ft diam galvanized steel, salt storage and dissolving tank and two 15-in. diam galvanized steel brine measuring tanks (one per softener) all complete with controls and accessories.

To provide a bacterially-safe water for building service, hypochlorite solution is delivered in proportion to flow into the softened water header to maintain a chlorine residual of approximately 0.2 ppm to 0.5 ppm leaving the service water tank.

Cooling Water

A two-cell, induced-draft, coil-shed type cooling tower is utilized to cool about 6000 gal per min of water from 102 F to 84 F. The major portion of the cooled water is passed over atmospheric cooling sections situated within the tower structure, collected in a sump and recirculated to the top of the tower. The remainder of the cooled water is collected in a separate sump, pumped through the plant cooling water circuit and returned to the top of the tower.

Raw water from the water storage tank is utilized for make-up. Sulfuric acid and chlorine are metered into the cooling water system at different points to precipitate solids and inhibit algae growth respectively. A continuous blowdown of approximately 25 gal per minute is maintained to prevent solids build-up in the system.

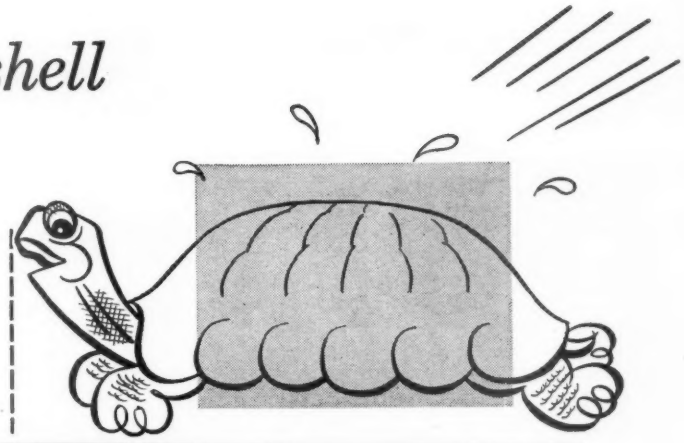


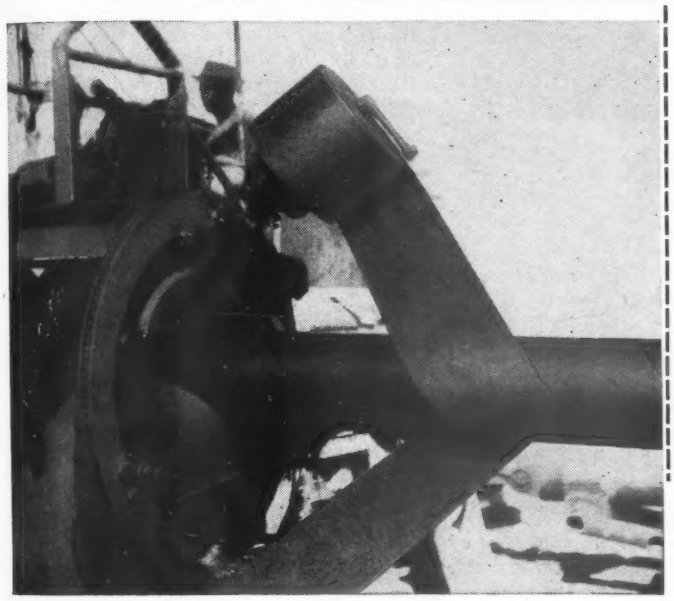
LEGEND

1. Feed gas
2. Residue gas
3. Separator liquid
4. First flash vapor
5. First flash liquid
6. Second flash vapor
7. Second flash liquid
8. Deethanizer overhead
9. Deethanizer bottoms
10. Deethanizer overhead
11. Deethanizer bottoms
12. Deethanizer overhead
13. Deethanizer bottoms
14. Initial gas returned to pipe line
15. Normal gas returned to pipe line
16. Future gas returned to pipe line

Flow chart of the liquid hydrocarbon extraction plant.

Like the turtle's tough shell that protects him so well...





Johns-Manville Asbestos Felt protects oil and gas pipe lines

Johns-Manville Asbestos Pipeline Felt now protects more than 100,000 miles of oil and gas pipe lines! *It is the only type of wrapper that has survived over 50 years of service in all types of soils.*

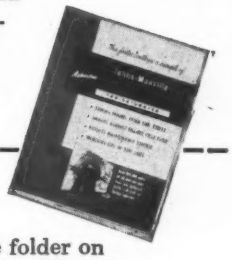
Johns-Manville Asbestos Felt is a sturdy product. It is resistant to rot and decay, and to acid and alkali soils. It has both the thickness and the toughness necessary for shielding pipe line enamels from damaging earth loads and soil stresses. These advantages make it possible for the protective enamel pipe coating to function properly against corrosion.

Johns-Manville Asbestos Felt is flexible. It wraps easily without cracking. It guards enamel from impact damage both during installation of field-wrapped pipe, and during transportation and installation of mill-wrapped pipe.

There are important economic benefits, too! Johns-Manville Asbestos Felt will help add many years to the life of the pipeline and help to keep maintenance costs low.

Johns-Manville Asbestos Pipeline Felt can be had in any width from 2″ to 60″, in any length desired.

For additional information and a sample of Johns-Manville Asbestos Pipeline Felt, simply fill in and mail the coupon provided below.



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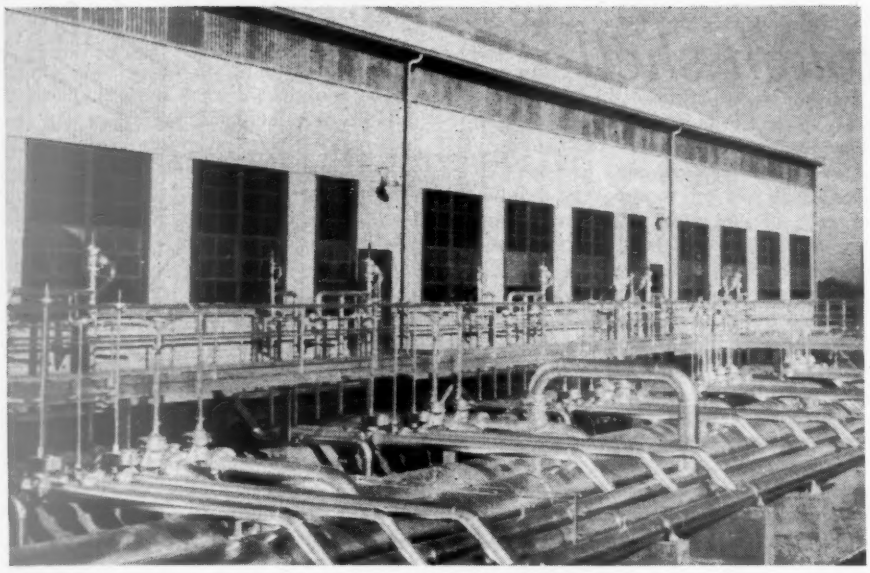

Headers for processed gas and flash gas compressors, situated on the company's natural gas transmission system near Gabe, Kentucky.

Jacket Water

Cooling water is circulated in a closed system through engine jackets, lube oil coolers, and the first stage flash gas and propane compressor cylinder jackets. All other compressor cylinder jackets are individually equipped with thermal siphon cooling systems, which are filled with ethylene glycol solution.

Approximately 10,800 gal per minute of water at 160 F is circulated by the jacket water pumps. Of this total, 3195 gal per minute is cooled to 120 F in air-cooled exchangers and then flows through the lube oil coolers. Water leaving the lube oil coolers at 126 F is blended with the balance of the 160 F water from the jacket water pump discharge to give about 10,800 gal per minute of 150 F water for engine and compressor cylinder jacket cooling. This water returns to the engine jacket water surge tank at 160 F for recirculation through the system.

The jacket water system is provided with controls that will automatically maintain proper flow quantities and temperature levels. A temperature controller maintains a constant temperature of 150 F in the blended stream to the engine jackets by controlling the amount of 160 F water that enters the stream. Another temperature controller insures that the temperature of the lube oil cooler stream does not drop below 120 F by adding 160 F water, as required.

A differential temperature controller maintains a constant 10-deg differential between water entering and leaving the engine jackets by controlling the total amount of water circulated.

Starting Air

A starting air system at 225-psi gage is maintained for starting the gas engine driven compressors and generators. Two starting air compressors and eight receivers are provided. Both compressors are equipped with electric motor drive, one of them having a stand-by gas engine drive as well.

Utility air-hose connections are provided on the starting air lines at convenient locations in the compressor house and auxiliary building.

Instrument Air

The instrument air system consists of a motor-driven compressor, aftercooler, receiver, filter, and package type dehydrator. Dry air at 60-psi gage is distributed to instruments and also utilized for pressuring the treated water storage tank. A connection from the starting air system, with pressure-reducing valve insures continuity of the instrument air supply in event of compressor failure.

Electric Power

Power for the operation of the plant is obtained from three gas engine driven generators situated in the auxiliary building. The gas engines are 880 hp, 8 cylinder, 327 rpm, each one direct connected to and driving a generator rated 750 kva, 0.8 pf, 480 v, 3 phase, 60 cycles, with a 15 kw, 125 v, 1750 rpm exciter driven from the generator shaft by means of a V-belt.

Power is generated and distributed at 480 v, 3 phase, 60 cycles. For control of generation and distribution, a main switchboard is installed in the auxiliary building, consisting of three generator panels, six feeder panels and two swinging panels. On each generator panel a 600-v, 1200-amp electrically operated air circuit breaker is provided, complete with inverse time overload and reverse current protection and other auxiliary control equipment. Fifteen breaker positions are provided on the six feeder panels. Of the two swinging panels, one is for generator control and for jacket water and generator engine alarms.

Cables from the main switchboard to the local motor control centers are run underground in concrete encased fiber ducts. The local control centers consist of groups of motor starters or feeder breakers with explosion-proof, watertight or general purpose enclosures as required. Double circuits are provided for the control centers at the jacket water coolers, the de-ethanizer structure, the cooling tower and the water-treating building. Circuit breakers are provided at these control centers so that the load may be divided between the circuits or connected selectively to either circuit.

From one position in the main 480-v switchgear, a circuit runs to a dry type air-cooled, 150-kva, three-phase lighting transformer situated near the switchgear in the auxiliary building. This transformer reduces the voltage from 480 v to 120/208 v, three-phase, four-wire grounded neutral, which voltage is supplied to the lighting distribution panel in the main switchgear. Sixteen three-phase lighting distribution circuits protected by 70-amp circuit breakers leave the bus, of which 13 are active and three are spares. The active circuits run to lighting cabinets for local distribution at the different buildings and other structures. The yard is lighted by means of floodlights mounted on tubular steel towers.

Ignition System

Two separate ignition systems for the gas compressors are provided, each of which originates at the main 480-v bus. In the main 480-v switchgear the voltage of each ignition circuit is reduced from 480-v to 120-v, three-phase, by means of two sets of small transformers. One circuit from each set of transformers runs in underground duct to the compressor house where the voltage is further reduced to 12 v and at that voltage the current is rectified by means of two full wave metallic rectifiers. The 12 v d-c from each rectifier unit goes to a three-wire bus, having a common neutral. The ignition system of each compressor gas engine may be switched selectively to either source of ignition power and indicating lights are provided for indication of the system to which the compressor is connected. An ignition and control board is provided for each compressor.

Provisions are made for automatic shutdown of all compressors from several process control points in the event of an emergency.

Communications System

A sound powered telephone system has been provided with stations in the office building, change room, control house, compressor building, and auxiliary building. The cable for the telephone system is run underground between stations.

The plant was designed and constructed by Stone and Webster Engineering Corporation of Boston, Massachusetts.

* * *

Here's a blueprint FOR INCREASING SPEED AND REDUCING WORRY

In 1932, Farrel developed a series of speed increasers which has taken at least some of the worry out of pipeline pumping station operation. For, of the hundreds of units installed in the oil industry since then, ***not a single one has ever failed in service.***

In view of this exceptional twenty-year record, you can feel confident that your own worries will be reduced when you specify *Farrel speed increasers.* These units are available in 49 standard sizes, with speed ratios ranging from 1:1 to 12:1. For higher ratios, units using two sets of gears are supplied with ratio range from 12:1 to 40:1.

For further information about these service-proved speed increasers, write for your copy of Bulletin No. 448A. No cost or obligation.

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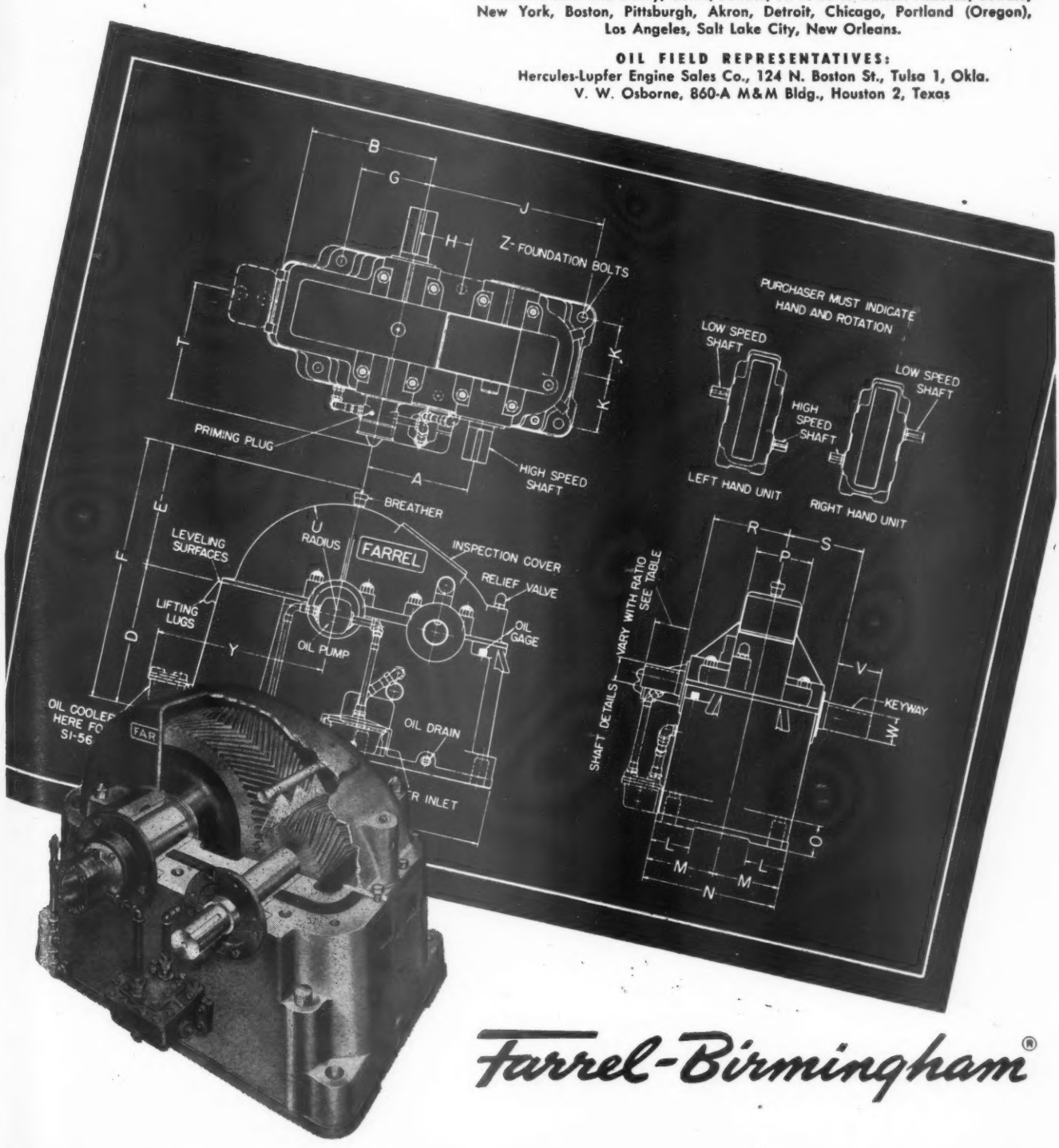

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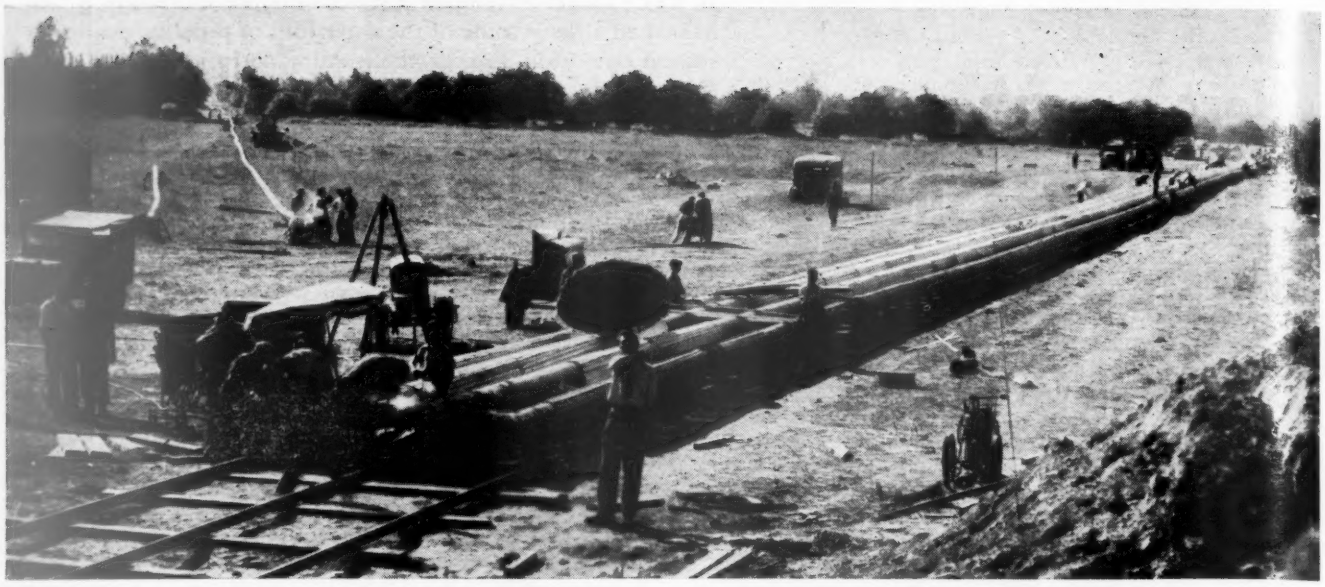


The crossing of the Seine at Aiziers was the most difficult because here four lines were installed simultaneously, two to transport gasoline to Paris and two for crude oil going from Le Havre to a refinery at Petit Couronne. A launching runway was constructed consisting of three parallel rails, upon which rollers, made of short lengths of pipe with welded guides on each end, moved along rail.

CROSSING THE SEINE RIVER

In laying a products pipe line connecting Paris with Normandy refineries Trapil had to cross many rivers, one of the most difficult being the Seine

TRAVAUX PIPE LINES (Trapil) are now in the process of laying a 150-mile products line from Normandy refineries to the Paris area. The line will be in operation by the fall of this year. The crossing of numerous rivers has added to the difficulties encountered in laying the line. These have included the Seine River at Aizier and Saint Adrian in Normandy and at Gennevilliers and Saint Ouen in the Paris area; the Oise, Andelle, and Epte rivers, and the canal at Tancarville.

The accompanying pictures show activity at crossings of the Seine at Gennevilliers near Paris and at Aizier in Normandy.

To place the lines in their proper position in the river, the head of the group of four pipes was picked up by a dragline positioned on a barge, as shown here. The barge holding the pipe was pulled across the river by winches situated on a barge moored on the opposite bank. To keep the "train" from moving too rapidly, a tractor was attached to the rear end to retard it.

New G-E combustion gas turbine—inherently suited for gas pipeline pumping—provides adjustable-speed flexibility for pipeline flow; saves water, oil and manpower!

A "natural" for gas pipeline pumping—that's General Electric's combustion gas turbine! Specifically designed for centrifugal compressor drive, it gives you low-cost operation. In addition:

—You can save on operating manpower and supplies. Power plant control is automatic and self-protecting, with all the important auxiliaries shaft-driven from the main unit.

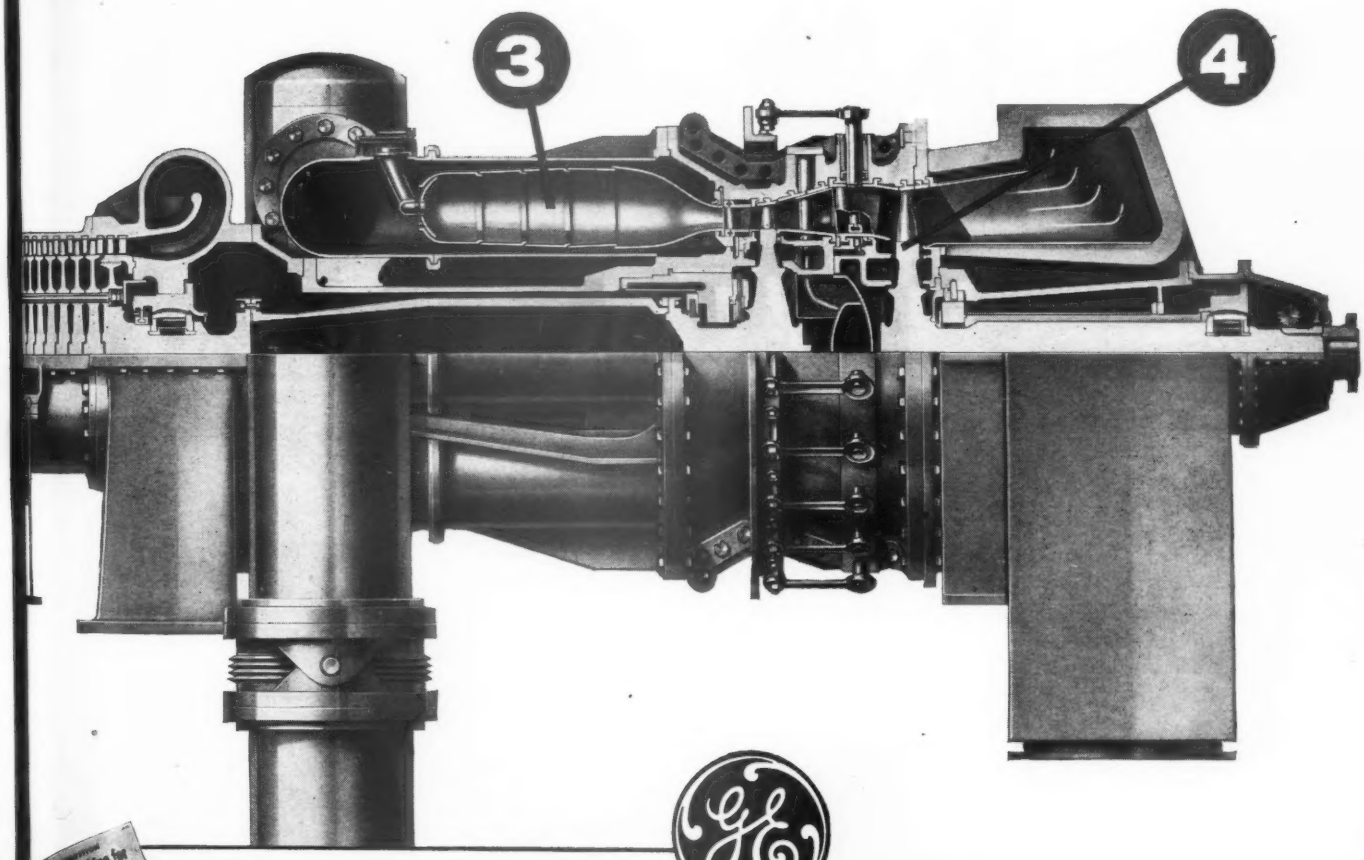
—You save on cooling water—an important point where water is scarce.

—You save on oil. A typical 5000-hp installation requires little or no make-up oil.

—You get adjustable speed for flexibility of operation to suit a variety of pipeline-flow conditions.

—You get up to 25 per cent extra hp in winter, when demand for gas is greatest.

Your G-E representative will gladly discuss this gas turbine in terms of *your* gas pipeline operation.



Send for New Bulletin!

A new 16-page illustrated booklet fully describes the G-E gas pipeline gas turbine. For your copy (Bulletin GEA-5530) call your nearest G-E sales office or write *Section* 661-30, *General Electric Co., Schenectady 5, N.Y.*

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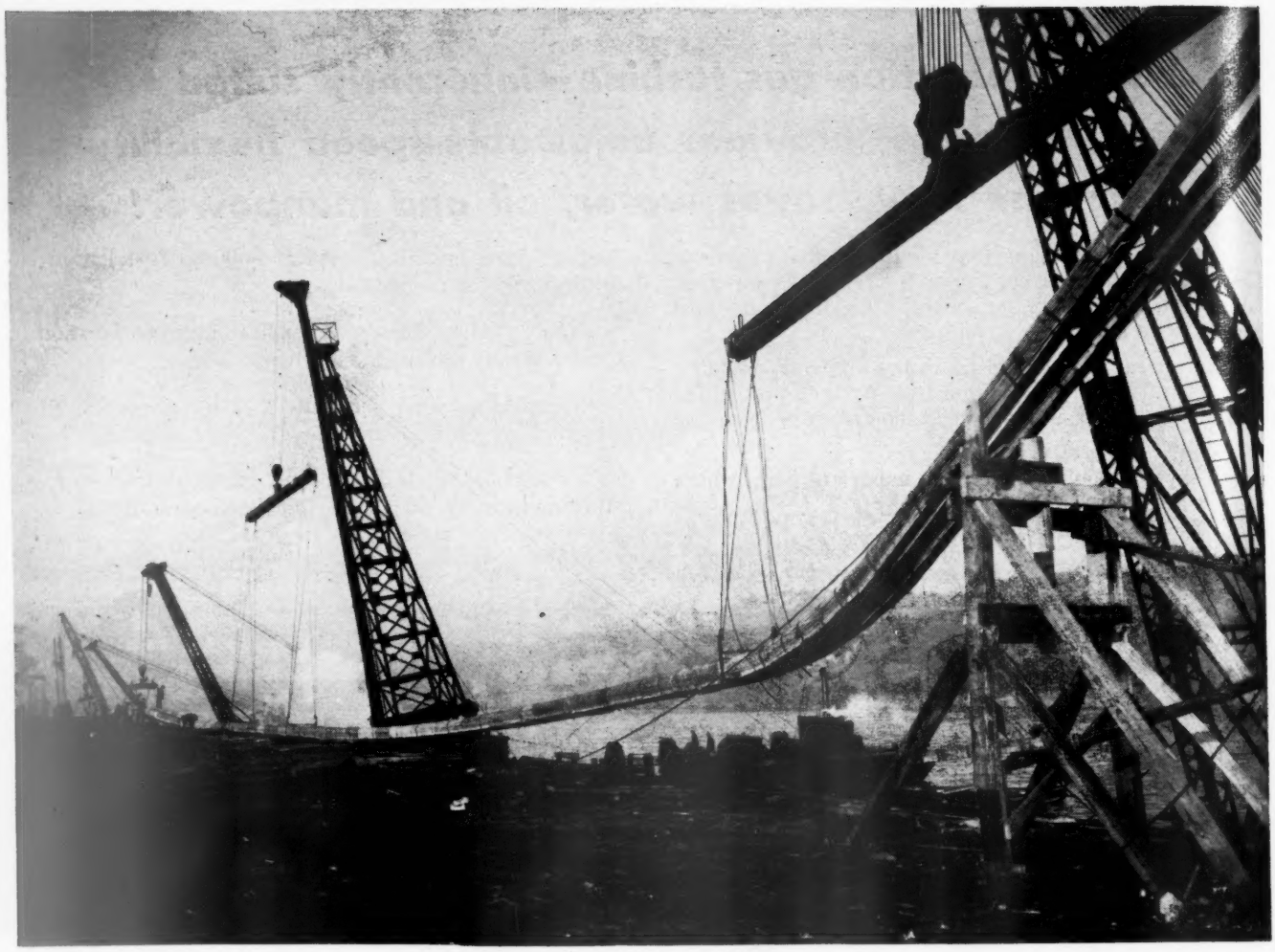
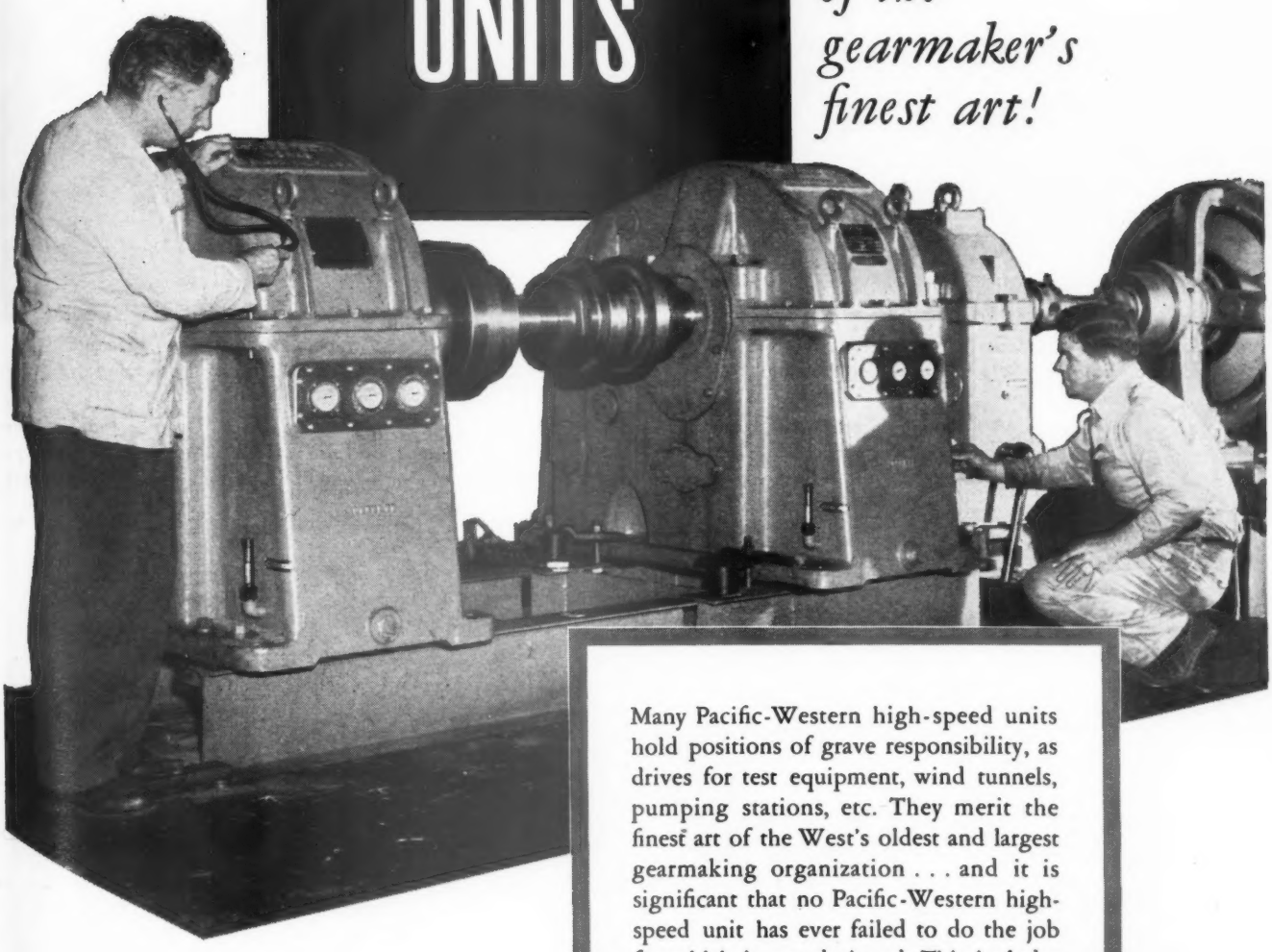


All crossings except the one at Aiziers consisted of double lines. The crossing shown here was of the Seine at Gennevilliers. The lines were laid from a pontoon bridge fashioned of barges. Here the pipe is being placed on the barges. As can be seen, the lines were bound to square wooden beams having a concave upper profile, which kept the pipe from rolling sideways.

The pipe lines rest on the pontoon bridge, from which they will be lowered into the river. Before being placed on the pontoons, however, the pipe was given two coatings of hot enamel plus a double wrapping of glass fiber. To protect the coating during handling, strips of wooden lath were secured to the pipe and sealed with hot enamel.

PACIFIC-WESTERN HIGH-SPEED UNITS

Examples of the gearmaker's finest art!



Many Pacific-Western high-speed units hold positions of grave responsibility, as drives for test equipment, wind tunnels, pumping stations, etc. They merit the finest art of the West's oldest and largest gearmaking organization . . . and it is significant that no Pacific-Western high-speed unit has ever failed to do the job for which it was designed. This includes high-speed units that have been on continuous duty for 20 years!

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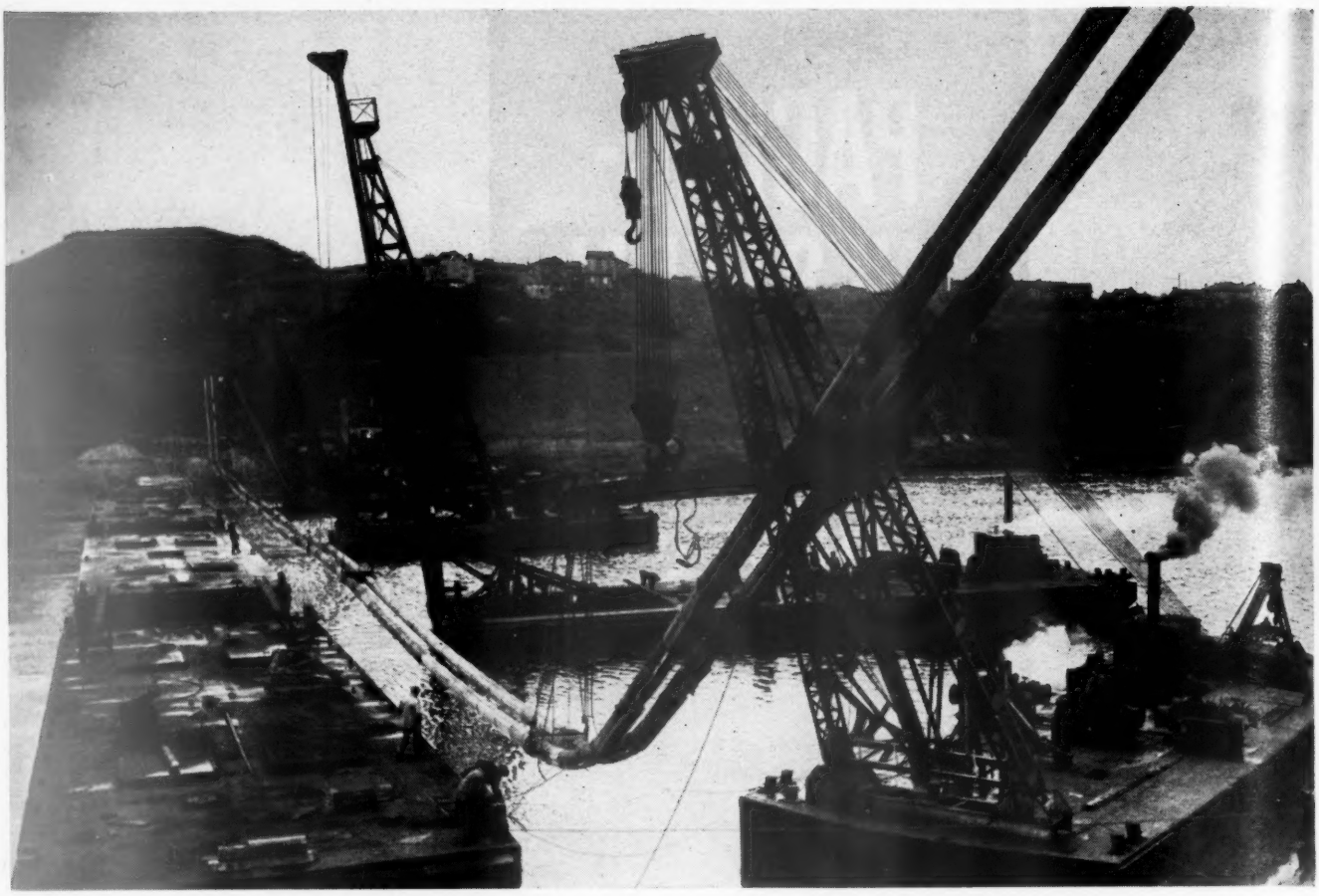
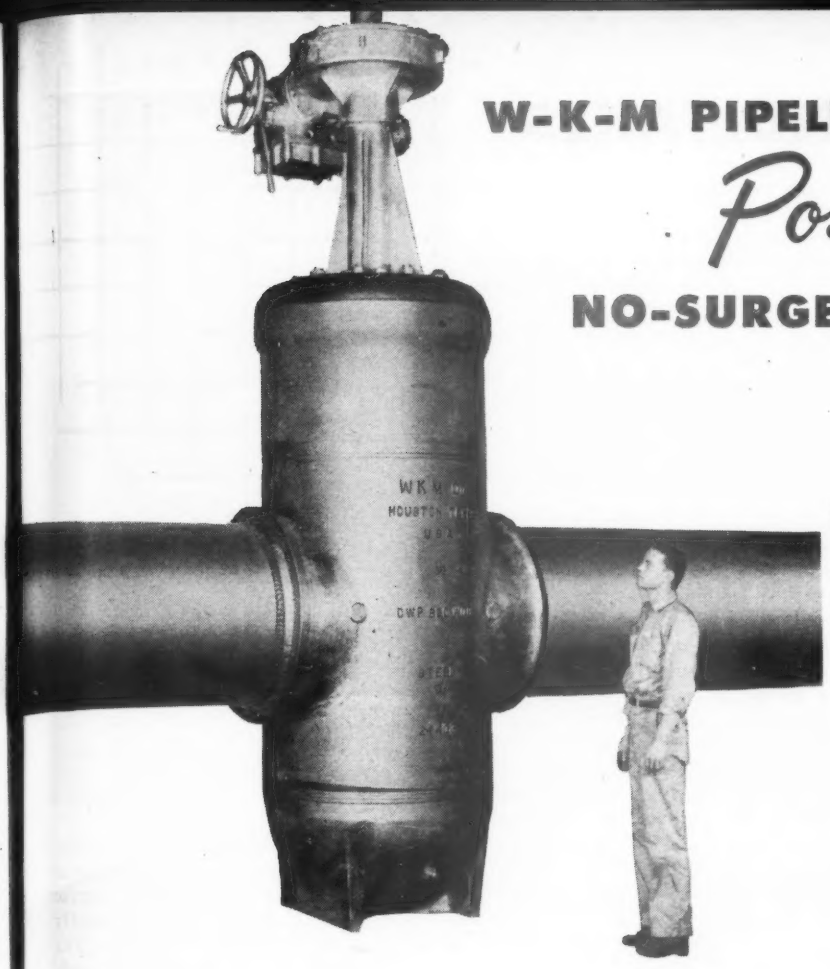
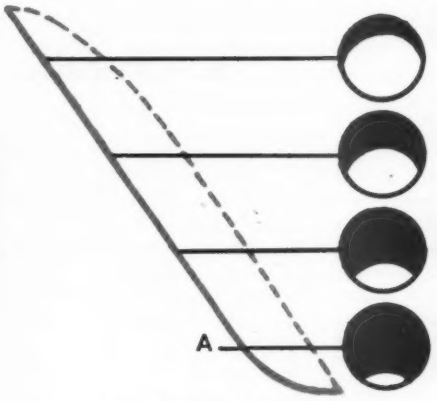


Lines are being lowered from pontoon bridge into the Seine. They were laid to a depth of 9 ft below bed of river to make them safe from ships anchors and dredging machines. Most of the rivers crossed are on a program of periodical dredging.

Lines are off the pontoon barges and being lowered, having just broken the river's surface. Greater than ordinary precautionary measures were taken in making these crossings because of the difficulty of repairing a pipe laid beneath a river. That is why, also, that parallel lines were laid—one for use and one for emergency.

W-K-M PIPELINE VALVES GIVE *Positive* NO-SURGE OPERATION





Dotted line shows closing curve of conventional gate valve.

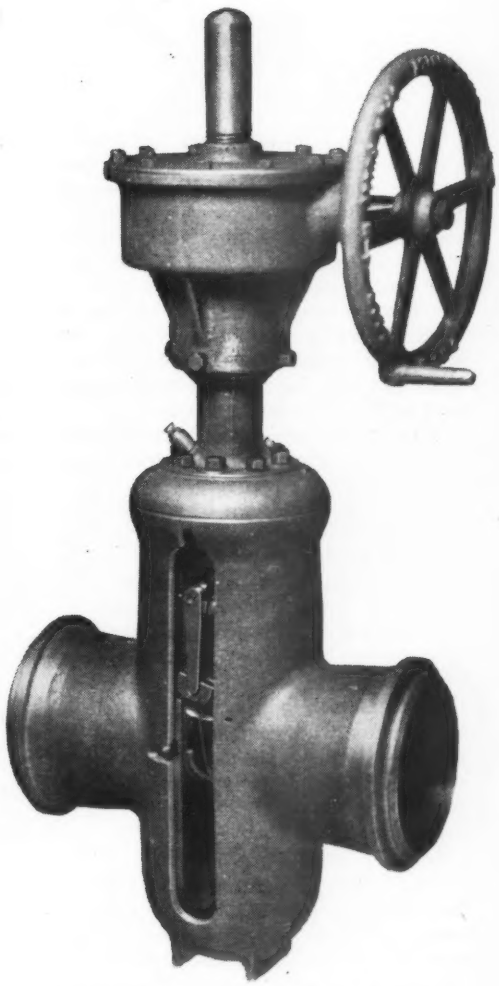
W-K-M Pipeline Valves may be closed as fast as required without setting up dangerous line surges.

There is no need to "baby" W-K-M Valves with partial hand operation or two-speed motor operators because they may be closed at a ***rapid constant speed, yet give the necessary gradual close off at the critical point to prevent surging.***

The curve above illustrates. From full-open to point A the rate of closing is almost straight-line. From point A (about 70% closed) the rate of closing slows up and approaches the fully closed position very slowly. In W-K-M Through Conduit Valves, the basic design of the gate and conduit provides just the right variable ratio of port area to gate travel to prevent surging, while the valve is operated at constant speed.

Specify W-K-M for surge-free closing as well as the many other advantages which have been proved and tested on the world's leading pipelines.

W-K-M Pipeline Valves have Through Conduit Design, Leverlock Operation, Parallel Expanding Gates, Pressure Seal Bonnets, Replaceable Seats.



W-K-M Valves are made in sizes from 2" to 30", in series 300-400-600-900-1500.

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W-K-M *Valves*

MOST OF THE WORLD'S NEWEST PIPELINES ARE TIED TOGETHER WITH W-K-M VALVES

FORETHOUGHT AND TAXES*

An outline of the basic principles for reducing taxes without reducing income

By IVERSON WALKER†

Iverson Walker when he gave this paper before Pipe Line Contractors Association.

In the short space of 30 minutes it is obviously impossible to give comprehensive treatment to a subject such as "Forethought and Taxes." We are faced with the choice of taking one item and discussing it in some detail or taking a bird's eye view of several items. Thinking it might prove of more interest to you, I have adopted the latter approach.

Taking forethought about taxes means, for our purposes, trying to minimize them.

Now there is no honest way of escaping taxes so long as we are earning income, except perhaps in the oil business. As long as our laws give different tax treatment to different kinds of transactions, however, there will be opportunities to do things the cheaper tax way rather than the more expensive tax way. But doing it the cheaper way usually requires forethought. A transaction handled without forethought is usually done the easiest way, and more often than not this is the most expensive way, for tax purposes. I think we should emphasize that tax minimization not only means taking advantage of legitimate means of reducing the tax burden, but also means avoiding tax traps, that is, avoiding transactions that appear to have favorable tax consequences, but which the government will probably construe as something else—something with very unfavorable tax consequences.

First, let us outline in our minds some of the basic principles of reducing taxes without reducing income:

One of the important basic principles or methods is taking capital gains instead of ordinary income.

Another basic approach is spreading the income among several taxpayers.

Another method is deferring income—or spreading it over a larger number of years.

Still another, is increasing deductions and credits. These are by no means all the basic methods but they will suffice to cover all the illustrations we will have time for today.

Capital Gains

Every man who earns his income the hard way and pays tax on it at ordinary rates looks with envy upon the investor who buys stocks, holds for six months or more, and then pays a maximum tax of 26 per cent on his gain. But our tax system is not designed to give capital gain treatment to a contractor's profit, or a tax accountant's fee, or a tax attorney's fee. And there is no magic formula, at least no safe one, for substituting capital gains tax for ordinary income tax. The closest approach to a magic formula was the so-called collapsible corporation or Hollywood corporation, which created potential income and then dissolved before realizing the income, so that the value created was taxed at capital gain rates. This device has now been effectively stopped by the Revenue Act of 1950 and the Amendment of 1951. By and large it never was a device that was workable in the construction business.

Although there is no safe way to avoid *all* ordinary income tax on the contractor's profit, it is possible to have the ordinary income taxes paid at corporate rates and then pay capital gain rates instead of ordinary dividend rates when the surplus is taken out of the corporation. Whether this method is an advantage over individual or partnership operation will depend, of course, on what brackets the individual may be in, how much excess profits credit the corporation has, and a number of other factors.

Assuming you have a corporation and have built up a surplus and have managed to stay away from Section 102 problems, how do you get the surplus out at capital gain rates? Ordinarily where a corporation completely liquidates any gain realized by the stockholders is a capital gain. So, the simplest way to take the surplus out at capital gains rates is to go out of business and dissolve or sell all the stock of the corporation.

But suppose you want to take some surplus out now, but don't want to go permanently out of business. Here the problem is not easy, and there are a dozen wrong ways to do it for every right one. Let me give you an illustration of one of the wrong ones. A fellow named Survaunt had a corporation with a substantial surplus and he dissolved it, lock, stock and barrel, and reported a capital gain. Shortly after the dissolution he organized a new corporation to engage in the same business and put into it all the properties of the old corporation except the surplus, which he kept in his pocket. The Commissioner of Internal Revenue contended that this was in substance a mere reorganization of the old company into a new one—not a real dissolution at all. If you take out surplus in the course of a reorganization, it is normally treated as a dividend. Well, the Tax Court and the Circuit Court of Appeals agreed with the Commissioner and Survaunt ended up paying most of that surplus to the government—in ordinary dividend taxes.[1]

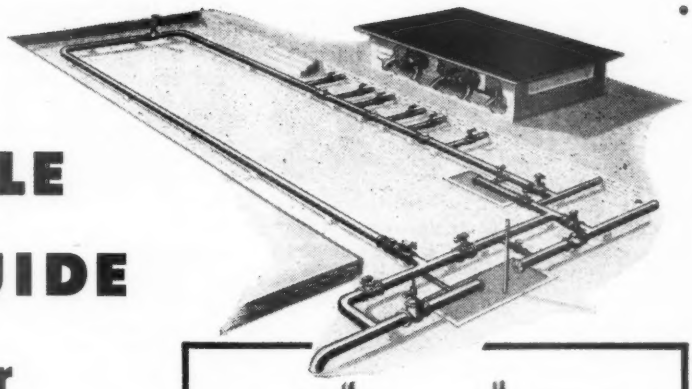
Now what could Survaunt have done to avoid this catastrophe? Basically there were three things wrong with his deal. First, he reincorporated immediately. Second, there was no change in the ownership of the business. Third, he put the same assets (minus the surplus) back in. It would have improved his chances a lot if he had deferred reincorporation for a substantial period. He could have improved it further by deferring any decision on reincorporation until he had tried individual or partnership operation for awhile, and then if and when he decided to reincorporate he should have reduced his interest in the new corporation below 80 per cent control and avoided, if possible, any transfer of assets from the old corporation to the new. In many businesses that is not easy to do, but in the construction business one can sometimes sell out completely and start over again from scratch.

Partial liquidations—unless they are merely steps in a complete liquidation—are to be avoided like the plague. Even where stock is redeemed the commissioner will usually contend that a partial liquidation is a dividend and will usually win. A good example of how not to partially liquidate is found in the case of a man named Lewis who owned most of the stock of a corporation that had a big surplus and two separate businesses. He

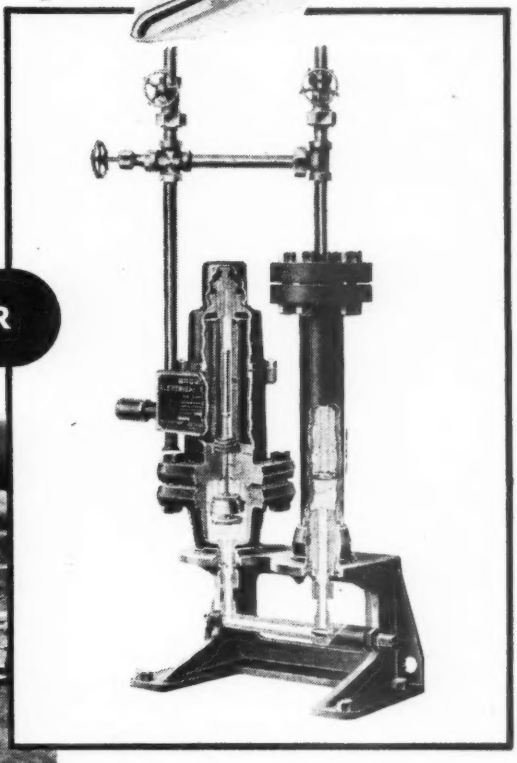
*Presented before Pipe Line Contractors Association, Houston, Texas, January 8, 1952.

†Carrington, Gowan, Johnson and Walker, Dallas, Texas.

[1]The facts of this case, Survaunt vs. Commissoner 162 Fed. (2nd) 753, have been simplified in the above discussion to illustrate the point which the case supports.



A DEPENDABLE OPERATING GUIDE for Crude Oil or Products Pumping Stations



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wanted to liquidate one of the businesses and continue the other. So he had the corporation transfer the going business to a new subsidiary corporation for all of its stock. Then the main corporation dissolved and distributed to him the cash and remaining assets, including the stock of the new corporation. He reported a capital gain on the assets received in liquidation, but here again the commissioner took the position that it was a reorganization and that any distribution made in the course of a reorganization was a dividend. After a long wrangle the courts finally upheld the commissioner. Now this is a very technical decision. If he hadn't gone through these maneuvers but merely made a direct partial liquidation of the defunct part of the business, I believe any sensible court would have held it a capital gain, because he had a real business reason for partial liquidation. This Lewis case illustrates what a technical business this is and how the way you do it may make the difference between an ordinary dividend and a capital gain.

There is one situation where a partial liquidation cannot normally be a dividend, that is, where the corporation redeems all stock of a particular stockholder so that he no longer has any interest in the corporation. This can't be construed as a dividend even though it comes out of surplus and the corporation keeps right on operating. There is some problem, however, if the one who gets out is closely related to those who stay in.

Even though it's dangerous to partially liquidate a single corporation, nevertheless a man may be able to successfully liquidate a part of his business at capital gain rates by having the business in several different corporations, so that one of them can be completely liquidated. It's pretty hard for the commissioner to construe this into a dividend if the corporations have been kept separate from the start. However, if the liquidated corporation has been recently split off from the main corporation, or if their businesses and properties are intertwined the risks are increased.

In this connection I might mention the spin-off provisions of the Revenue Act of 1951, which permit a corporation to be divided, tax-free, into two or more corporations, all owned directly by the stockholders. This statute does not apply where used as a device to distribute a dividend, and the tax consequences of a spin-off that does not comply with the statute are so severe that one would not normally attempt it without an advance ruling from the commissioner. The commissioner will undoubtedly require assurances that there is no plan to dissolve the new corporation after it is spun-off.

Single job corporations, if they can be kept separate from the main corporation, and especially if new interests can be brought into them, offer opportunities for capital gains in the construction business that are not available in many lines. I might mention here that a corporation, of however short duration, is not treated as a collapsible corporation under present law if it earns and pays tax on its income before dissolution.

We have been thinking about ways and means of taking surplus out at capital gain rates instead of as dividends; however, we should give thought to the possibility of not taking anything out of the corporation at all. If the corporation is in a position to keep on expanding so as to avoid the Section 102 penalty, and if the corporation is in a fairly favorable excess profits position, then there is something to be said for leaving your wealth in the corporation and being satisfied with salary and expenses for your personal needs. In other words, instead of struggling to get money out of the corporation into your pocket, just let the corporation be your pocket. Of course, this involves some disadvantages and limitations, and involves leaving your wealth at the risk of the business, but there are advantages worth thinking about. If the principal stockholder can maintain this position until he dies then his stock will get a stepped-up basis by reason of death and the heirs can then sell or liquidate the business without even paying a capital gains tax.

Spreading Income

Now let us turn to another basic tax saving method, that is, spreading of income. Spreading income among several taxpayers will reduce taxes if it results either in lower brackets or a greater number of exemptions. Of course, corporation income tax rates are not graduated above $25,000 except as to the ceiling tax on new corporations. So the use of multiple corporations is chiefly advantageous in making available a greater number of $25,000 exemptions from the surtax and excess profits tax. It must be pointed out, however, that where all the corporations involved will "hit the ceiling" for excess profits tax purposes, then the use of multiple corporations does not produce any excess profits tax saving except in the case of new corporations. The use of multiple corporations owned by the same stockholders has been under fairly constant attack by the Treasury Department. In the field of litigation the commissioner has had his best luck where the taxpayer tried to divide a single corporation into multiple corporations, and his poorest luck where the corporations were separate from the start. As you know, the Treasury attempted to get a section in the 1951 Act to deny multiple exemptions for corporations 95 per cent controlled by the same interests, but Congress watered this down to denial of additional exemptions where a new corporation is created by transfer of part of the property from the old, and where a non-tax motive cannot be proved. The commissioner has no authority to deny the additional credits to new corporations that are not created by transfer of property from the old. So multiple corporations can still produce multiple exemptions if they are separate from the start. However, the commissioner has authority for reallocating income back to the main corporation if the income is really attributable to the main corporation's property, contracts, and personnel.

Another method of spreading the income that may prove advantageous in some situations is the use of a partnership either for all or a part of the business. This method of doing business is becoming increasingly attractive taxwise since corporation rates have grown so large and since the family partnership provisions of the 1951 Act now permit the bringing of children into the partnership for a greater division of income. The 1951 family partnership amendments are hedged about with conditions designed to insure that the children are the real owners of the interest transferred to them and that no income is allocated to them that is attributable to the personal services of the father. But even so, the amendments are a real step forward in permitting division of income among members of the family. While I don't pretend to be any authority in Wage Stabilization problems, I am given to understand that if employees are brought into a partnership as bona fide partners then wage stabilization has no application to their earnings; however, this subject is fraught with hazards where the so-called partnership might be called a subterfuge.

When a part of a business is conducted by a corporation and another by a partnership, care must be used to see that the commissioner has no ground for claiming that the income of the partnership is attributable to the corporation, or vice versa. The commissioner has litigated a lot of these cases, and while not too successful he has been persistent.

Deferring Income

While we are on the subject of spreading income, there is also the possibility of spreading it over a greater number of years, by deferring income. You are, of course, familiar with the election to use the completed contract method or the percentage of completion method for long term contracts. Another situation is where a contractor guarantees certain phases of a job for a short period of time. He may be able to defer a portion of his income until the guaranty expires. An example of how not to do this, if you want some income deferred, is found in the case of Spencer White and Prentis, Inc.[2] where the contractor got paid in full and then set up a reserve to cover possible liability on his guaranty. Although the reserve was reasonable from a business standpoint, it was not deductible on his tax return because the revenue laws make no provision for deducting reserves except in the case of depreciation and bad debts. If the contractor had been willing to leave the same amount of money with the owner and had had the forethought to include in his contract a provision that the owner would withhold that sum for the period of the guaranty, then the contractor would probably have been successful in postponing taking this sum into income until it was due him under the contract.

One of the very important means of

[2] 144 Fed. (2nd) 45.

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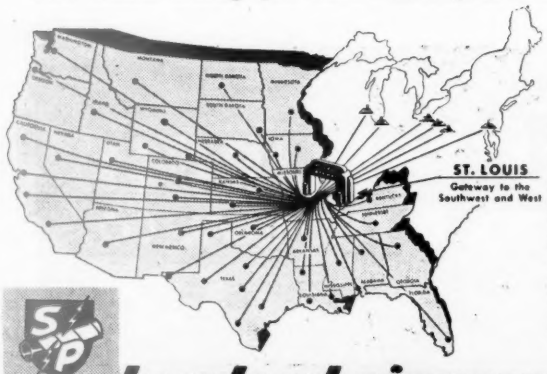
1G	Yes	Yes	Primer	3/32" Enamel	Glass	Kraft				Yes
1XF	Yes	Yes	Primer	3/32" Enamel	Asbestos Felt	2/32" Enamel	Kraft			Yes
1XG	Yes	Yes	Primer	3/32" Enamel	Glass	2/32" Enamel	Kraft			Yes
2F	Yes	Yes	Primer	3/32" Enamel	Asbestos Felt	2/32" Enamel	Asbestos Felt	Kraft		Yes
2G	Yes	Yes	Primer	3/32" Enamel	Glass	2/32" Enamel	Glass	Kraft		Yes
2GF	Yes	Yes	Primer	3/32" Enamel	Glass	2/32" Enamel	Asbestos Felt	Kraft		Yes
2XF	Yes	Yes	Primer	3/32" Enamel	Asbestos Felt	2/32" Enamel	Asbestos Felt	2/32" Enamel	Kraft	Yes
2XG	Yes	Yes	Primer	3/32" Enamel	Glass	2/32" Enamel	Glass	2/32" Enamel	Kraft	Yes
2XGF	Yes	Yes	Primer	3/32" Enamel	Glass	2/32" Enamel	Asbestos Felt	2/32" Enamel	Kraft	Yes

First enamel coating 3/32" thick—subsequent enamel coatings 2/32" thick.



COATING AND WRAPPING-IN-TRANSIT

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deferring income made available by the Revenue Act is the use of profit sharing and pension trusts. When a corporation is in a period of high earnings it would like to pay commensurately high salaries to its officers and employees, especially if the high earning period may be thought to be temporary. But it is deterred to some extent by the realization that Uncle Sam would get a large slice of the increased compensation, especially from the supervisory personnel. There is further the problem that the corporation may have to argue with the revenue agent about the reasonableness of the compensation, when it comes to deduct it. And now, of course, we have wage stabilization standing in our way.

Now a profit sharing trust may be an answer to all these problems. First, as you probably know, the contributions made by the corporation to the trust are deductible when made but these contributions are not taxable to the employee until paid over to him. So here we have a means of deferring taxable income. Further a profit sharing trust must have Bureau approval and of course once it is obtained there is no problem about reasonableness of compensation. As to wage stabilization I understand they are still formulating policy on profit sharing plans but it is thought they will be liberal since the profit sharing plan does not increase present compensation. Meanwhile the Bureau will let you insert a clause to recover the contributions if they are ultimately disapproved by the wage stabilization boys.

Now profit sharing trusts are important. Most of us, if we want to lay aside something for the lean years, can only lay aside what's left after taxes. To be able to lay something aside before taxes is a real benefit. However, in order to qualify, a profit sharing trust must benefit employees who have no stock in the company as well as those who do. It can be limited to certain classes of employees but it cannot be used as a device to unduly benefit officers and supervisory personnel.

Now on the subject of deductions and credits. Deductions are usually not *created* without paying out more money, but deductions to some extent can be accelerated. Most taxpayers feel they can improve their position by accelerating deductions though over the long pull, and with constantly rising tax rates, they have usually been wrong. But for the taxpayer who is paying excess profits taxes, taking everything he can legitimately get now and letting the future take care of itself, looks like a good gamble.

This is no place to start talking about depreciation rates and methods but I will say one thing. Not having your rates questioned by the examining agent is nine-tenths of the battle—or perhaps I should say, ten-tenths. If there is any one thing that hits a revenue agent in the face it is the consistent taking of capital gains on the sale of depreciable equipment. If this happens consistently on a large scale the revenue agent can usually

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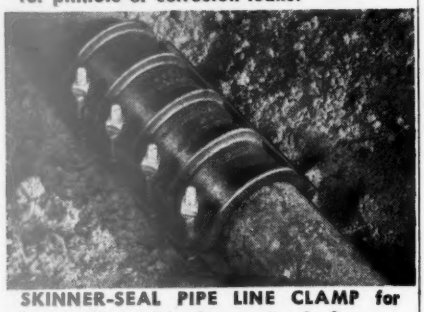

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think of only two possible explanations: Either the market for the equipment has gone up, or you are taking depreciation too fast. Many revenue agents don't mind your eating your cake if it is gone when you get through, but if you eat it and then have it too through capital gains sales, then a question is indicated even to the most liberal agent. If you have equipment that is depreciated below market value (and this may happen perfectly legitimately) is is usually advisable to trade rather than sell, even though this means less depreciation on the new equipment.

While we are on the subject of deductions, the use of a rental-purchase agreement for acquiring equipment is often thought of as a method of accelerating deductions. This is perfectly legitimate financing device, but as a tax saving device it has its limitations. Many such agreements are not questioned, but if it gets questioned it may be treated as an installment purchase instead of rental. In that case the payments are not deductible but are capitalized and depreciation allowed instead. Briefly, here are some of the things that point to a purchase rather than a true rental contract. (We are assuming in all these cases that the contractor has an option to buy at the end of the lease or at some point in the lease). First, if the rental payments are excessively high in comparison to what you would be willing to pay if you didn't have a purchase option. Second, if the option is to purchase at a nominal figure long before the useful life of the equipment expires. Third, if the so-called rents are to be credited against the normal purchase price of the equipment. The combination of these factors will lose a case for you if it gets to court, and any one of them may result in litigation of doubtful outcome. Looking at the matter from a practical standpoint, however, you may say we have all to gain and nothing to lose by trying, but this may not be entirely so. Whether you call it rent or installment purchase, the price you ultimately pay will usually have an interest factor in it. If your contract calls it a purchase and sets out the interest separately then interest as well as depreciation is deductible. On the other hand, where a "rental" contract is construed as a purchase, the commissioner will not usually construe any of it as interest. Under certain types of contracts where rent is construed as a purchase there is some risk that depreciation will be allowed only on what has been paid.

How can a rental agreement be made to stand up as rent? Of course, the sure, but not so desirable, method is to leave out the purchase option. Assuming you want to be protected with a purchase option, your position is greatly improved if the rental rate is not too high, if the upset price is substantial, and formulas for crediting rentals on the price are avoided.

Passing now to the subject of credits, we have time for only one illustration. Early in World War II there developed a popular device of buying up an insolvent corporation in order to acquire its operating loss carry-overs and its excess profits credits. Section 129 of the Internal Revenue Code, enacted in 1943, was designed to plug this loophole but the plug has some leaks around it. In the first place, Section 129 applies that is, it denies the use of the carry-over and credit only where the acquiring of the losses or credits is the principal purpose of the transaction. Where the corporation that has the losses and credits also has valuable equipment or other properties that make the transaction a legitimate business transaction then it can be argued that the acquisition of the equipment is the dominant motive and the acquisition of the losses and credits a subordinate purpose. This is, of course, a question of fact in every case but the Tax Court has been fairly liberal with the taxpayer on this issue. Secondly, there is considerable doubt whether Section 129 applies at all where the losses and credits are used by the same corporation that originally had them, that is, where you put income into the insolvent corporation instead of trying to take the credits out.

This method of minimizing taxes is not without its hazards. On paper it sounds like an all to gain nothing to lose type of deal, but actually the shifting of income from a going concern to the insolvent corporation is often a ticklish business, involving substantial risks, and has possibilities of leading into a trap.

You will note that many of the examples I have given are accompanied by a word of warning as to the hazards involved. It is perfectly legitimate for the taxpayer to minimize taxes in any lawful way and so long as there is no concealment of facts, but the commissioner also considers it perfectly legitimate to get as much tax as he can. The courts have repeatedly said that in tax matters they will look at the substance of the transaction and not at its form. The commissioner has taken this doctrine and run wild with it in some cases. All too often his idea of what is substance is what will produce the most tax, regardless of the realities of the situation, and transactions that do not follow normal business between patterns are the ones he is most likely to try to construe into something different, like the Survaunt and Lewis cases that I mentioned earlier, where liquidation was construed as being in substance a dividend. Most of you will probably recall the story for children about the colored boy Epaminondas. His mammy had just finished baking a batch of fresh pies and put them out on the back porch to cool. Epaminondas was playing around on the porch and the mammy, knowing how careless small boys are, said: "Epaminondas, you be careful how you step in them pies." So Epaminondas was careful and stepped very carefully in the exact middle of every pie. I believe some of the same ambiguous advice may be appropriate in transactions designed for tax savings. "Be careful how you step in them pies." ★ ★ ★

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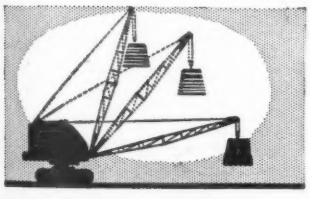

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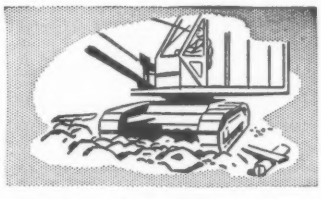

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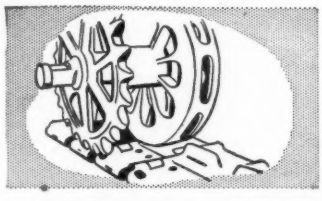

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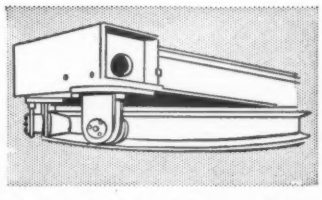

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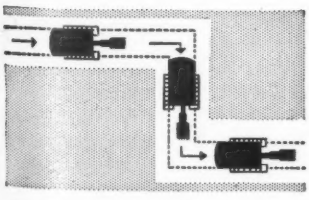

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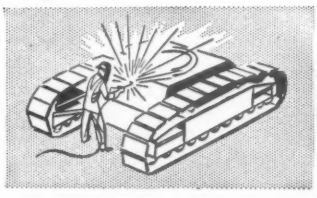

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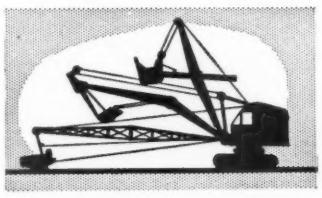

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CRUDE OIL GAGING TECHNIQUES

Millions of dollars are involved in the buying and selling of crude oil, making speed and accuracy essential in gaging

H. L. POHL

THE buying and selling of crude oil is an exceedingly important phase of the petroleum industry because millions of dollars are involved. For the most part, crude oil is bought and sold on the basis of gages made in tanks both large and small to determine the quantity and quality of oil involved. Therefore, it is not difficult to see that the techniques in gaging are most important as they represent dollars and cents to the buyers and sellers of crude oil. The techniques used in gaging are slightly different for delivery tanks than for small tanks in the field. In all cases there is a sincere effort on the part of the buyer and the seller to determine accurately and honestly the quantity and quality of crude oil involved in each transaction.

In the gaging of both field tanks and delivery tanks, every effort is made to combine laboratory precision and field expediency into a practical, economical method without the loss of accuracy. There is no doubt that laboratory methods of determining the temperature of a tank of oil, sampling of a tank of oil, and of determining the properties of the representative sample from the tank are the most exacting and accurate; however, in actual practice, it is necessary for the sake of economy to carry out these operations as rapidly as possible and still obtain results of high accuracy. The little techniques in gaging are the things that will help to obtain this speed without sacrificing accuracy.

Henry L. Pohl is supervisor of chief gagers, Sinclair Pipe Line Company. He was born March 6, 1887, in Jefferson City, Missouri, and became associated with the petroleum industry in 1917, checking materials and equipment in the oil fields. Since that time he has held the following positions successively: Warehouse and materials man, gager, chief gager, scout, district superintendent, and supervisor of chief gagers. His continuous service with the Sinclair organization dates from October, 1918.

Gaging Field Tanks

In the gaging of field tanks, a quick examination of the tank before making any attempt to gage may disclose a leaking draw-off or connection, or even a leaking tank. The gager will then know that he need not spend any time gaging the tank until proper repairs have been made. In gaging the tank itself, considerable time can be saved if the gager will use a definite routine on each tank. Any such routine should be so arranged that the tank cup-case thermometer remains in the tank for at least five minutes. To expedite the gaging operation, the thermometer should be placed in the tank immediately upon starting the gaging operation and left there until it is finished. As the average temperature of the entire tank of oil is desired, care should be exercised in placing the thermometer at the proper point in the oil. In field tank gaging, a nearly average value can be obtained by placing the thermometer half way down in the oil in the tank as far from the shell of the tank as possible. The average temperature of the crude oil in the tank is quite important because an error of only 2 or 3 deg may cause a much larger error in calculating the quantity of oil in a tank than a error made in reading the gage line. When reading the tank thermometer, as well as a thermometer in a combination hydrometer - thermometer, the instrument should be held as nearly as possible in a vertical position with the top of the mercury column in the thermometer on a level with the eye. When reading the thermometer, the gager should know the exact number of degrees represented by each division on the thermometer.

The gaging or testing of a quantity of oil of necessity involves the obtaining of a representative sample of the oil in the tank. In some cases a truly representative sample may be obtained by taking equal amounts from the middle of the oil in the tank and oil at the connection height and combining the samples to make a composite sample, or, by taking equal amounts from the top, middle, and connection heights of the oil in the tank and combining into a composite sample. The gager should exercise care to take these samples from the prescribed levels and not just a sample from any place in the oil in the tank. The container that the gager carries to put these samples into must be perfectly clean or the entire operation will not represent the accuracy that is intended and the purpose of the operation will be nullified as the sample then will no longer be thoroughly representative of the crude oil in the tank.

When the sample is being obtained with a thief, the thief should be opened and let down into the oil to the proper height and snapped. The thief full of oil is then brought to the surface. The sample should not be taken from the first few inches of oil in the thief, since this oil may not be representative of the oil at the level desired due to the fact that it is washed by the oil as the sample is pulled up through the tank of oil.

Test for Gravity

One of the most important determinations in the gaging of crude oil is the test for gravity. In all cases, this gravity determination, is made in degrees API. The gager obtains the sample of oil for the gravity determination from a point midway between the oil surface and the bottom of the tank. The sample is taken by means of the oil thief, which can be hung on the side of the gage hatch while the gravity of the oil is being determined. For field operations, a combination thermometer-hydrometer type instrument is used as it gives as accurate a reading as a regular hydrometer and does not necessitate the use of a separate thermometer. With the oil thief in a vertical position and the oil surface free of bubbles, the thermo-hydrometer should be carefully lowered into the oil to a point slightly below that to which it will sink naturally. The instrument should be handled by the bulb end whenever possible to avoid breakage. The thermo-hydrometer also should not be allowed to have oil on the entire stem above the oil surface as this added weight may cause an error in the gravity reading. It has been determined that a proper reading can be obtained only after the thermo-hydrometer has been in the oil at least three minutes.

To properly and correctly read the hydrometer, the eye should be on a level with the top of the oil surface, and the reading should be made only when the hydrometer is at rest and not touching the side of the thief. From this observed reading, a deduction of one-tenth degree API should be made for the meniscus or

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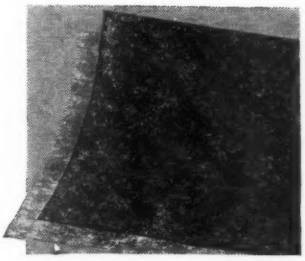

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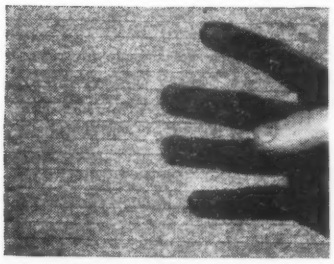

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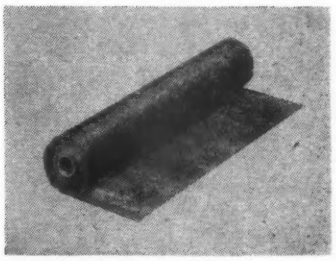

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Crude oil gaging kit containing oil thief, wood-back thermometer, hydrometers with carrying case, oil gaging tape complete with frame and bob, thief carrying case, hand centrifuge, and hand centrifuge carrying case.

capillary attraction of the oil on the stem of the hydrometer. This one-tenth degree deduction has been determined by experiment for the usual type of hydrometers used in crude oil work.

After the observed gravity has been read, the instrument should be raised high enough to read the thermometer, but yet leave the stem immersed in the oil. This temperature is known as the observed temperature. Inasmuch as all crude oil is bought and sold on a basis of the gravity at 60 F, the gravity at 60 F of the observed gravity and temperature may be readily obtained from the gravity correction charts for crude oil as published by the National Bureau of Standards. In using these correction charts, it should be noted that one method is used for correcting tenths of a degree observed gravity up to and including five-tenths of a degree API, whereas another method is used above five-tenths.

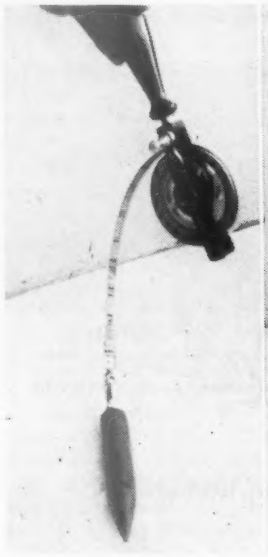
In gaging field tanks of oil, all gages should be made from the same point on the hatch. There should be no obstructions on the tank bottom that might affect the accuracy of the gaging. The oil should be at rest and free from foam and bubbles. The plumb bob of the gage line should be lowered slowly through the oil so that the first contact with the gage bottom is noted. A gage pole may be used on small field tanks and, if so, the gage pole must be held perpendicular and must not hit the bottom hard enough to cause ripples and a subsequent high reading. The pole is perpendicular if, when standing directly over the pole, the reflection of the pole in the oil lines up with the oil. All gages of field tanks are made to the nearest quarter of an inch. It is a good policy to check all gages. To expedite the complete gaging of a tank, the gage of the height of oil in the tank should be made during the time that the thermo-hydrometer is adjusting itself to the conditions of the oil in the thief during the gravity test.

Sediment and Water

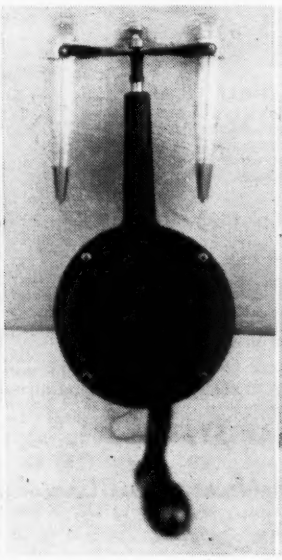
In determining the height of sediment and water in the bottom of a tank, care should be exercised to lower the thief slowly through the sediment. If the thief is lowered too rapidly, the sediment will partially be shoved aside and a low reading given. For pouring oil from the thief to determine the amount of sediment and water, the contents should be poured over the bulb end of the thermohydrometer or a piece of glass, rather than over the head. This makes it easier to determine when the sediment and water show up.

From a representative sample, the test for sediment and water is made by means of a centrifuge. The tubes used in this centrifuge test should be the tubes approved and designated by the API Code 25. Use of tubes not approved may lead to errors because such tubes do not meet the required specifications adopted by the API. It is absolutely necessary that the sample be thoroughly shaken before being placed in the centrifuge tube in order that once again a representative sample be obtained. In the field, it is a good idea to fill the centrifuge tube to the halfway mark with the oil sample and then add the benzene,

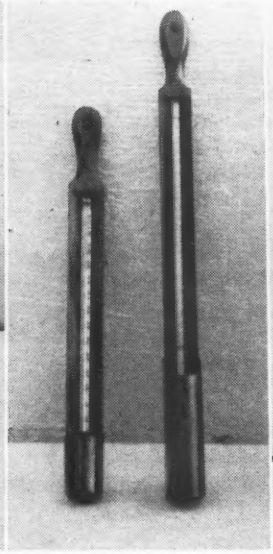
Oil gaging steel tape complete with frame and bob.



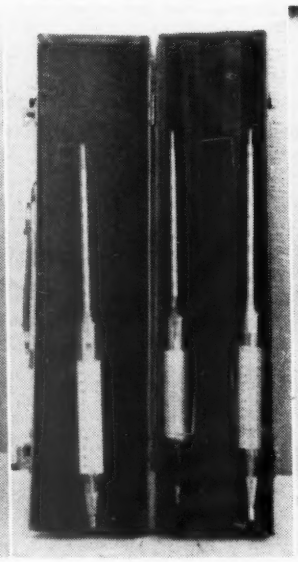
Hand centrifuge machine complete with two place head and aluminum shields and two API 12.5 ml graduated centrifuge tubes.



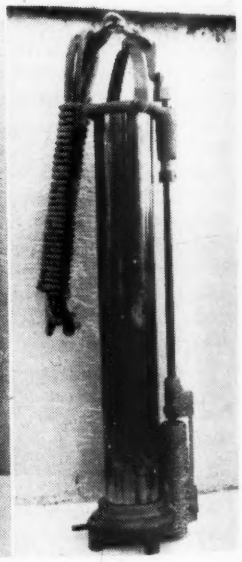
These are two types of cup-case, wood-back tank thermometers.



Three-compartment hydrometer carrying case with three thermometer-hydrometers of different ranges of API gravity.



Oil sampling thief complete with rope and snap. Tulsa style thief.



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ELL, WYOMING, TUESDAY, OCTOBER 9,
O'Connor's Crew Setting Record In Laying Pipe Line
Claiming the world's record for a one-unit ditch digger, George W. O'Connor, head of the O'Connor Construction company which is currently digging and laying a gas pipe line from the Two-Dot gas wells to Warren, Montana, said that his crew had dug 17,200 feet of ditch last Thursday.
"As far as I know this is a world's record for a one-unit ditcher," said O'Connor, "and most ditch-men would call me a liar if I made this statement to them." O'Connor said that his crew had ideal soil for ditching last Thursday on the bench of Elk Basin. He said that he had working for him, Fagin Rehm, whom he described as the best ditcher operator in the area. Rehm's home is in Burley, Idaho.
The O'Connor Construction company of Fromberg, Montana, has a Cleveland ditcher powered by a diesel International Harvester company UD-9. The company's crew is still laying six-inch pipe. The last 18 miles of the pipe line to Warren will be eight-inch pipe. O'Connor said that his crew had
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GEORGE O'CONNOR'S

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for the simple reason that even though a little too much or too little benzene is added, no difference in the final reading will result. If the benzene is put in first and then the oil is added, any error in adding the oil below or above the 100 per cent mark will cause a subsequent error in the final reading.

After the centrifuge tube has been filled, it should always be thoroughly shaken to mix the oil and benzene. To obtain correct results from the centrifuge test, it is necessary to heat the tube and its ingredients to 120 F. This can be accomplished rather easily by electric or water heaters, either stationary or mounted in the gager's car. It is also possible to heat the tube by means of a small inexpensive sheet metal heater or by a small piece of gasoline soaked waste; this requires extreme caution when in the vicinity of the tank. The heated tube and sample should then be placed in a centrifuge machine and whirled for at least three minutes or longer as required.

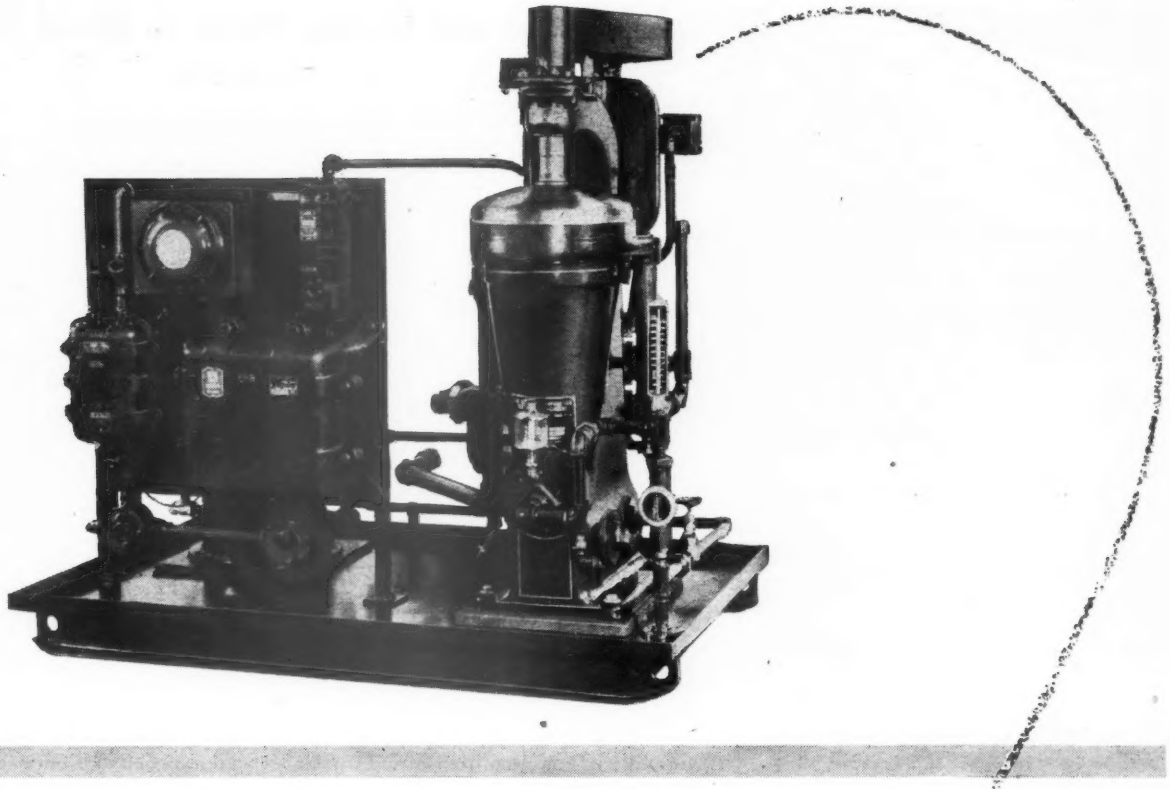
Small electric centrifuge machines than can be carried in the gagers' cars often expedite this testing as the whirling is carried out for a longer period of time and with much more ease than when a hand centrifuge machine is used. With the hand grinding machine there is a tendency not to whirl the sample as long as it should be whirled.

Gaging Delivery Tanks

In gaging delivery tanks much the same procedure is used as in gaging field tanks, but, due to the differences in sizes of tanks and of the parties involved, some practices are a little different. Frequently a pipe line sample is collected automatically, by taking samples hourly of the oil going into the delivery tank. Depending upon the agreement of the parties, such composite samples may be used to determine the gravity, the sediment, and water content. In most cases, this method of automatic sampling has been tested and proved to provide a completely representative sample.

The delivery tanks are gaged with a gage line just as are the field tanks, but the gage line is read to the nearest one-eighth inch. In some cases where there is considerable sediment in the bottom of the tank, an extra heavy bob is used to penetrate to the bottom of the tank. When such bobs are used, extreme care is necessary to get the correct gage readings. In many cases, automatic or electric gages are used on delivery tanks, merely for hourly checks, however, they are not to be used as a basis for a delivery gage, due to the fact that an automatic gage can be changed quite easily, or may be incorrect for other reasons.

In the gaging of all tanks of any size or type, extreme care should be taken to make all readings correctly. This applies in particular to errors due to misreading the gage lines, the hydrometers, the thermometers, and the centrifuge tubes. The technique of checking each reading will tend to eliminate many such errors. ★ ★ ★



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Lubrication and Cooling Water in Diesel Operation

W. F. SCHAPHORST

THE two factors that are most important in the operation of a diesel engine are: (1) Lubrication, and (2) cooling water.

Although lubrication is the more important of the two, they are interrelated. Thus, for instance, the writer has in mind a diesel of well known make that was allowed to operate for too long a period with a cooling water temperature of approximately 200 F. If the cooling water had been distilled, or even conditioned, it wouldn't have been so serious, but this water was "bad"; it wasn't treated in any way.

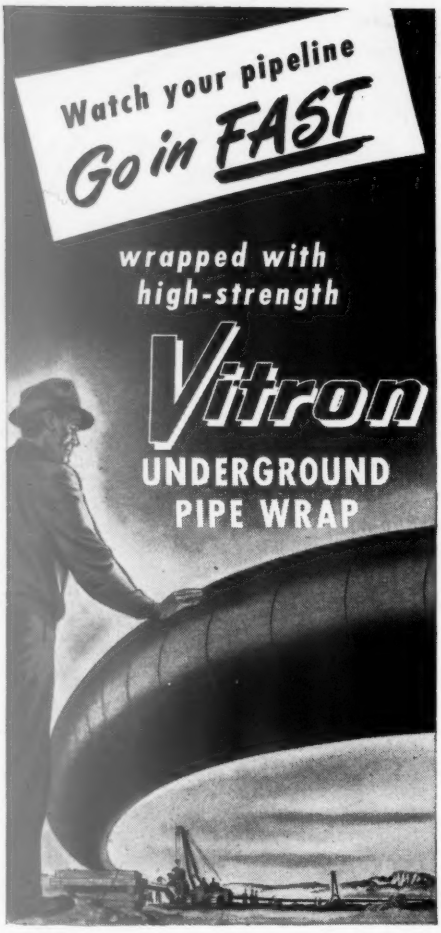
Scale accumulations built up in the cooling jacket, of course, and clogged the passages. That led to high cylinder wall temperatures and the lubricating oil couldn't function properly—and that is where cooling water and lubrication are interrelated. The pistons stuck, scored the walls, and wore excessively.

Finally an "expert" was called, and it didn't take him long to put his finger on the cause of the trouble—the impure cooling water.

Going back to lubrication, have you ever noticed on reading through your diesel operating manual that lubrication is mentioned oftener than anything else? That, in a way, emphasizes its importance. Lubrication is what keeps the engine from wearing out quickly. All other conditions being right, lubrication is what permits the diesel to operate at its remarkably high efficiency.

There is such a thing, too, as giving a diesel too much lubricant, believe it or not. It is well to be careful about that point although too much is better than too little. By giving the engine too much oil, carbon deposits will be formed. If such deposits persist in forming, don't blame the lubricating oil but blame yourself. The best way to oil a diesel engine is to use a force feed lubricator, feeding the oil directly onto the piston between the piston rings. Attach the lubricator to the engine and mechanize it in such a way that the amount of oil fed is in direct proportion to the number of strokes. Feed the oil against the piston while it is at the end of its stroke so that the oil will "catch".

The color of lubricating oil has nothing to do with its capacity to lubricate. Therefore, don't be enticed into buying a "good-looking" oil simply for its looks. The lubrication problem is well worth studying carefully. Study both the lubricant and your engine and when the lubrication problem is once solved you will be surprised at the small amount of attention that the engine will demand of you. To flood an engine cylinder with oil may eliminate much of the friction but, on the other hand, it may cause serious and costly trouble. * * *



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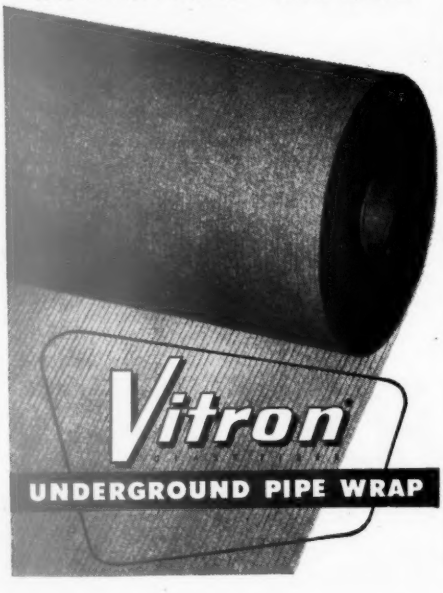

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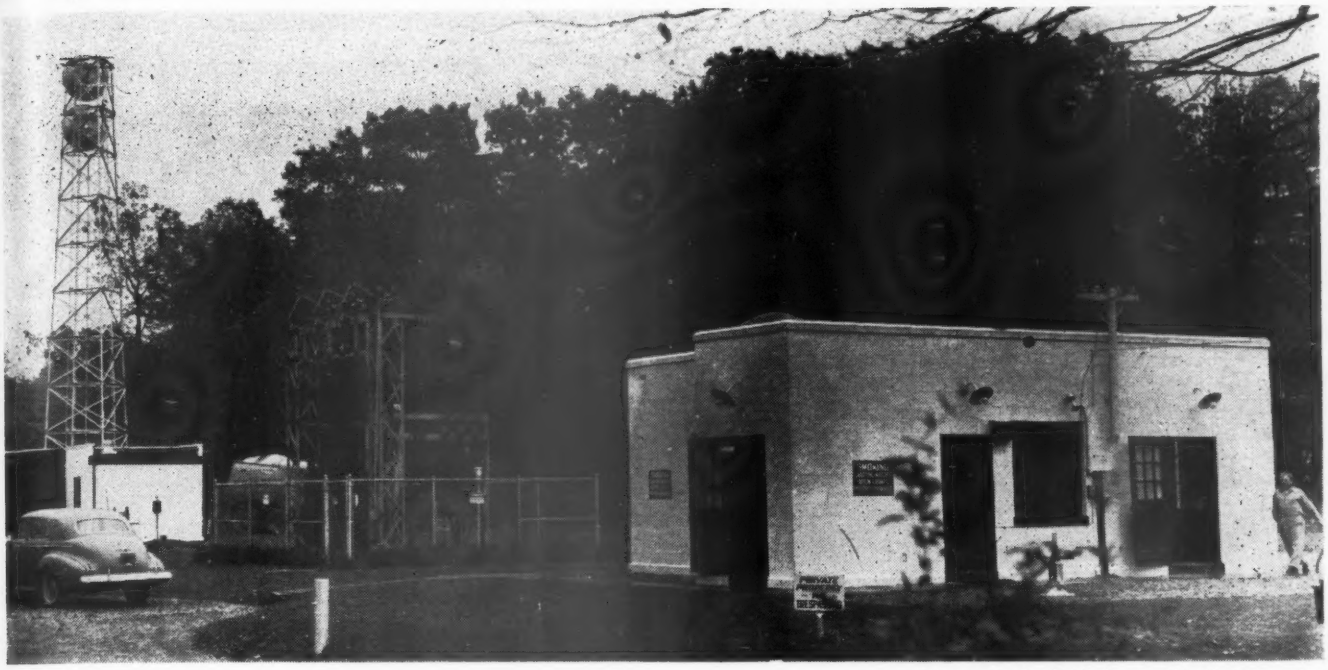


—Courtesy Federal Telephone and Radio Corporation.

Microwave installation at Boot pumping station of the Keystone Pipe Line Company.

Microwave Communication Links

Factors that make uninterrupted communication service possible even under the severest weather conditions

JOSEPH RACKER

THE severe storms that have swept the country in the last few years, causing extensive damage to wire lines, served to spotlight the need for communication systems that operate dependably under all weather conditions. It has been particularly distressing to pipe line companies that the very same meteorological conditions that resulted in disruption of pumping station operations, and even flow of gas and oil, similarly affected wire lines. Hence, just when communications were most urgently required, they have been most susceptible to failure.

Microwave radio communications ("microwaves" are defined later) represent an excellent solution to this problem. This has been proved in a number of installations where microwave radio was completely unaffected by storm, ice, rain, fog, snow, or magnetic storm. In several instances the link, as it is called, continued to provide reliable, uninterrupted communications during periods when all wire lines were out of service for a week or two. Actual recorded outage time in commercial, 24-hr a day, operation is about one-third that of equivalent wire lines. Furthermore, as a special characteristic of microwave propagation, it is susceptible to failure mainly during the period between 11 p.m. and 4 a.m. when lines are lightly loaded.

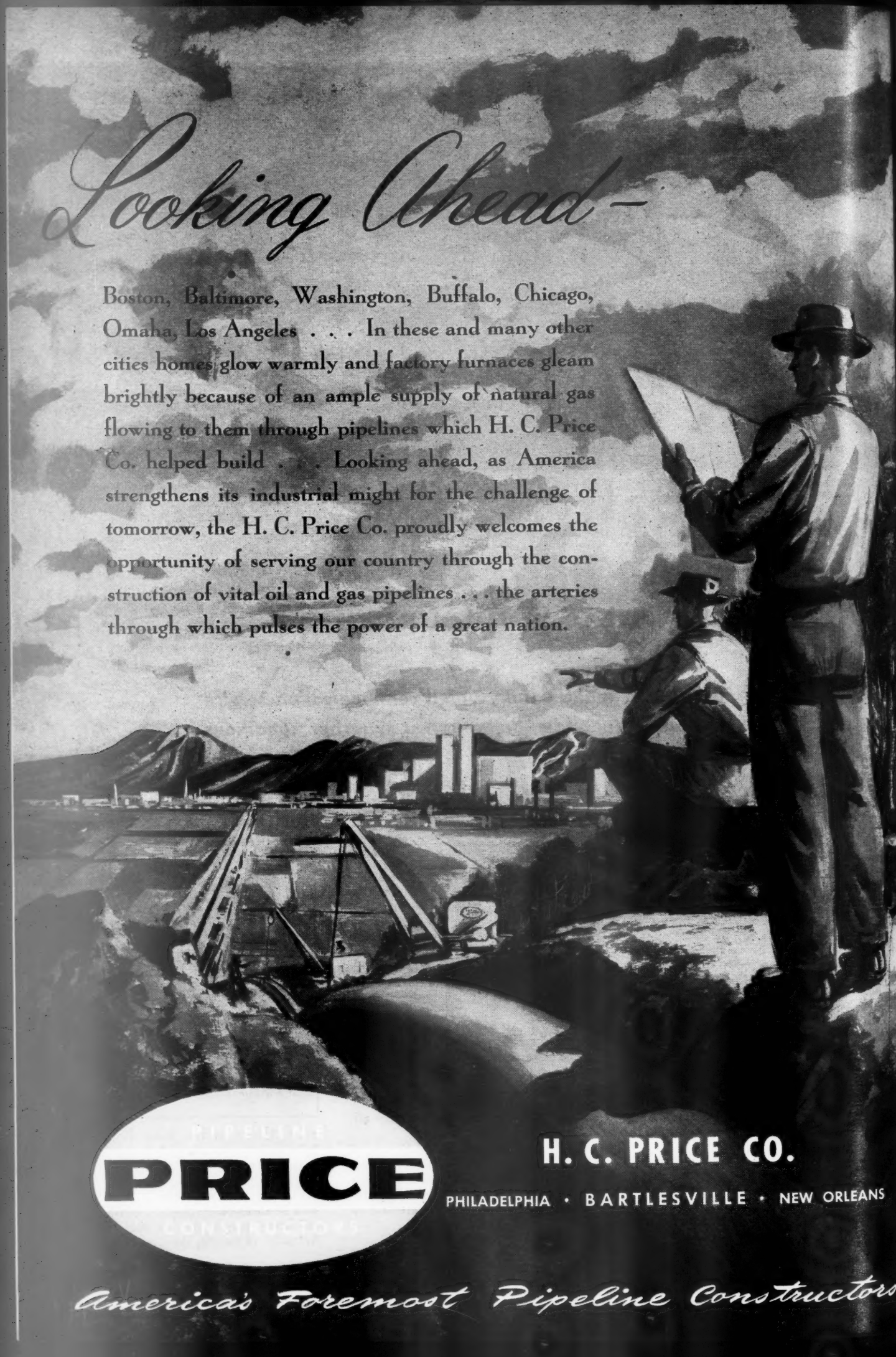
These advantages of microwave radio are derived from one fundamental factor. Communications are relayed from one point to another through *air*, rather than wire lines. For long distance communication, a number of repeaters are necessary to perform similar function to repeaters in telephone lines, that is they receive, amplify, and retransmit the original signal. Transmission of the intelligence is effected through the air, however.

Consider the advantages of the use of "air" rather than "wire" lines. Air is free, and already installed. On the other hand wire is made of expensive, hard-to-get material and must be erected on poles. Hence, in the initial installation "air" is more economical than wire. Air is indestructible, it can't be torn down or displaced. It doesn't have to be maintained, serviced, or replaced. These facts may seem to be completely obvious and yet many people do not realize them. Actually, of course, the price advantage

EXCLUSIVE

The Author

Joseph Racker heads the firm of Joseph Racker Company, New York City, microwave consultants. He has had wide experience in the field, including more than six years with International Telephone and Telegraph Corporation. He is co-author of the text "Pulse Techniques" and author of "Fundamentals of Microwave Communications."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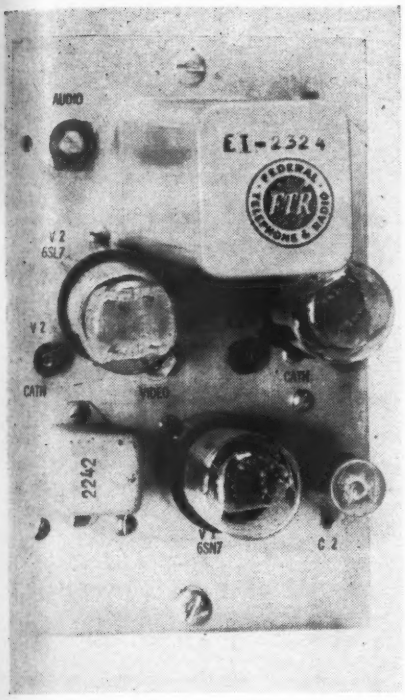

FIG. 1. Channels are added to a microwave communication link by simple plug-connected units shown here.

—*Federal Telephone and Radio Corp.*

of microwave links is not as great as the cost of telephone lines *minus* wire and pole line expense. Microwave links at the present time cannot take full advantage of mass production factors, however. Even today, without the mass production advantages, microwave radio is considerably less costly than equivalent wire lines for distance of more than 25 miles and when more than 4 channels are used.

A further advantage of the microwave radio is that the initial installations can be readily expanded. In the case of cables or other wire lines, it is usually necessary to include in the initial installation many pairs of wires solely for the purpose of meeting anticipated future expansion. If the future expansion is underestimated, additional facilities can only be obtained by a costly capital expenditure. On the other hand, if the anticipated expansion is not obtained, then many pairs of wires are idle and serve no useful purpose. It is not feasible to transfer lines from one wire line route to another.

Microwave radio links can be built up on the basis of actual traffic demands and can be economically expanded. Starting with any desired number of channels, additional speech-band channels up to the link maximum (23 in several links) can readily be added. In the link manufactured by Federal Telephone and Radio Corporation, additional channels are obtained by simple plug connected units, shown in Fig. 1, which are inserted in the existing link. These units can be obtained as the need for them arises.

Each voice channel of the 23 can, of

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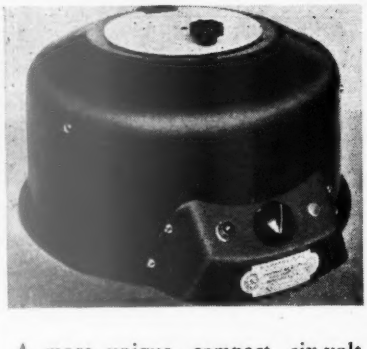

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course, provide its equivalent in telegraph, teletype, and telemetering circuit through the use of carrier. The link can be integrated with mobile radiotelephone to extend the range of the mobile operation over the full communication system. In addition, it is readily adaptable to drop channel operation for tie-in to intermediate points, and all channels can be terminated on a 2-wire basis suitable for telephone subsets, or PABX switching employing conventional ringing or dialling methods.

The channel facilities that can be provided include the following:

(1) Telephone circuits.
(2) Telegraph circuits.
(3) Telemetering circuits.
(4) Broadcast transmission.
(5) Remote control circuits.
(6) Supervisory control circuits.
(7) Fault locator circuits.
(8) Mobile telephone circuits.

Any and all of these services can be incorporated in a communication link exactly in the same manner as they are integrated in cable or wire line installations.

What Microwaves Are

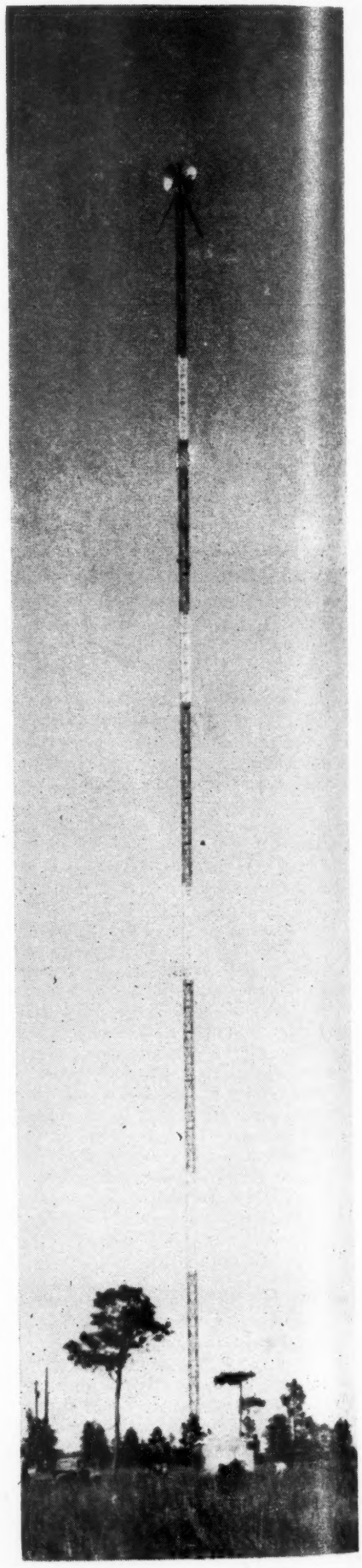
So much for the various reasons for using microwave radio. The rest of this article will be devoted to describing some of the principles and equipment available for pipe line communication. First, we will show what microwaves are and why they are used.

The air is literally filled with radio signals. Each signal has its own distinguishing characteristic known as a frequency. To prevent one signal from interfering with another, different services must operate on different frequencies. Radio broadcasting operates in one range of frequencies. Television operates on another, FM on a third, mobile on a fourth, and so on for each service. Consequently, a new frequency band is required each time a new application of radio is discovered or an old service must be expanded.

Generally speaking new bands are obtained by using higher and higher frequencies. For example present TV stations operate on what is known as the high frequency, or H-F, range. To provide additional facilities in areas where the H-F range has been exhausted, the Federal Communication Commission (FCC) is now considering allocation of frequency bands for TV in a higher range known as the ultra-high-frequency (U-H-F).

Microwaves, at the present time, constitute the highest frequency range used for radio purposes. Microwaves are defined as those frequencies above 1,000,000,000 cycles per second, or 1000 megacycles per second. Although lower frequency ranges are overly crowded providing spectrum for AM, FM, TV, mobile radio, short wave, and so on, there is considerable space available in the microwave region. Services using microwaves are not crowded together. As a result it is possible to simplify equipment design and operation because a freer use of frequency spectrum is

Typical tower installation used for Transcontinental Gas Pipe Line Corp.
—*General Electric Company.*



allowed. At lower frequencies very strict FCC regulations are imposed to make sure that services do not interfere with each other.

In addition to its availability there are other reasons for using microwaves. At microwave frequencies it is possible to use simple, small size antennas to "beam" the radio waves in much the same way that an automobile headlight beams light. In other words, instead of scattering the energy in all directions, the microwave antennna concentrates it in the desired direction. The result is a much higher degree of radiation efficiency. For example, a 1-watt transmitter using typical microwave antennas provides the equivalent service of a 1,000,000-watt transmitter that radiates energy in all directions. Because a small amount of power is necessary, the day-by-day operating costs, as well as initial manufacture and installation cost, is greatly reduced.

Microwaves are similar to light waves in that they are limited to "line of sight" distances. Thus while lower frequency signals may be received many hundreds of miles away from the intended reception point, microwaves are rarely received at any point other than within the communication link area. Furthermore, noise such as caused by lightning, spark plugs, and other static producing devices, becomes less and less powerful as the frequency increases. This noise has a much greater effect on broadcast frequencies than it does at the higher TV frequencies. Its effect at microwave frequencies is zero for all practical purposes. Hence, use of microwave frequencies cuts down the two main causes of interference, namely; (1) other radio signals and (2) natural and man-made noises.

Finally, an important advantage of microwaves for radio communication is that its propagation characteristics during climatic conditions that create storms, ice, sleet, fog, etc., are usually excellent. Hence, microwave communication are most dependable during periods when they are most urgently needed.

Multiplexing of Channels

It should be noted at this point that microwaves do not carry the voice by itself. It merely provides the means of getting a message from one point to another in much the same way that wire lines are use as a path for transmitting messages. Hence, it is necessary to superimpose or modulate the message on the microwave energy. Often the method of modulation used is dependent upon how simultaneous transmission of many channels—an important advantage of microwave radio — is accomplished. Simultaneous transmission of many channels over one link is called multiplexing.

There are a number of methods of modulation and multiplexing available to the engineer. Each has certain advantages and disadvantages. It is interesting to note that each of the four best known microwave links manufactured today employs a different method of modulation. Before considering the different methods of modulation, however, we will first review two basic methods of multiplexing.

One system, known as frequency division method, is used in the type K carrier system. In frequency division systems, each voice channel is identified with a sub-carrier frequency. For example, a four-channel frequency division system may have sub-carrier frequencies of 10, 20, 30, and 40 kc. Each voice circuit modulates the sub-carrier identified with its channel. The modulated sub-carriers are then used to modulate the microwave signal. At the receiver these channels are separated by frequency selection and the sub-carrier filtered out, restoring the original audio signal. A serious problem in this system is cross-modulation introduced by nonlinearities in repeaters.

To understand the second system of multiplexing, known as time multiplexing, we will first consider a very simple system; namely, two telephones connected by a wire as shown in Fig. 2. A conversation is held over this line. Now a switch is inserted in the line and switches the line in and out of the system. If this is done slowly, the two people talking over the line will hear their conversation interrupted periodically as the switch cuts them off and on again. Assume, however, that the

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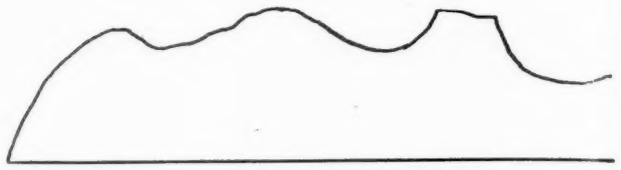
switch is turned on and off with increasing rapidity. As the switch speed increases, the interruption will be less and less evident until, beyond some point, there won't be any apparent interruption at all.

This effect is similar to what the eye experiences when witnessing motion pictures. Actually the pictures consist of a number of still shots shown very rapidly. The pictures are switched so rapidly that the eye cannot see the switch but does see a "motion picture." Similarly, if the conversation is switched on and off fast enough, the ear hears a continuous sound. Thus two people can conduct a conversation over a line that is actually being switched off and on without hearing any break in the conversation.

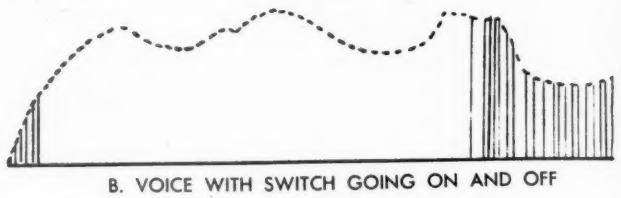
A picture can be taken of the conversation by a device known as an oscilloscope or simply the scope. When this scope is placed on the line without the switch, the conversation will take the form of some *continuous* wriggly line as shown in Fig. 3A. When the scope is placed on the line with the switch, however, the conversation will take the form of a closely spaced dashed line, as shown in Fig. 3B, whose overall outline is the same as the continuous waveform seen before. Each of these dashes is called a pulse. If the pulses are close enough, you can hardly tell the difference between the continuous and dashed lines.

We have seen that a conversation can

FIG. 2. Telephone line with switch.



A. VOICE WITHOUT SWITCH



B. VOICE WITH SWITCH GOING ON AND OFF

FIG. 3. (A and B) Oscillogram of conversation.

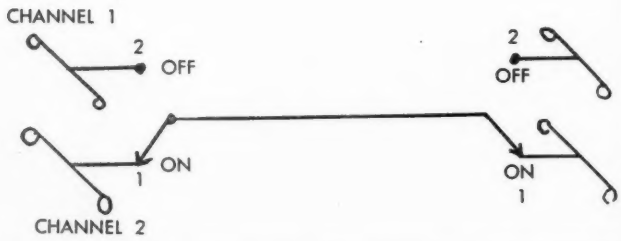


FIG. 4. Two-channel time multiplex system.

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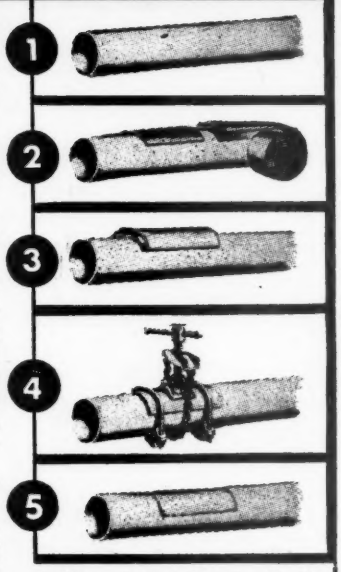

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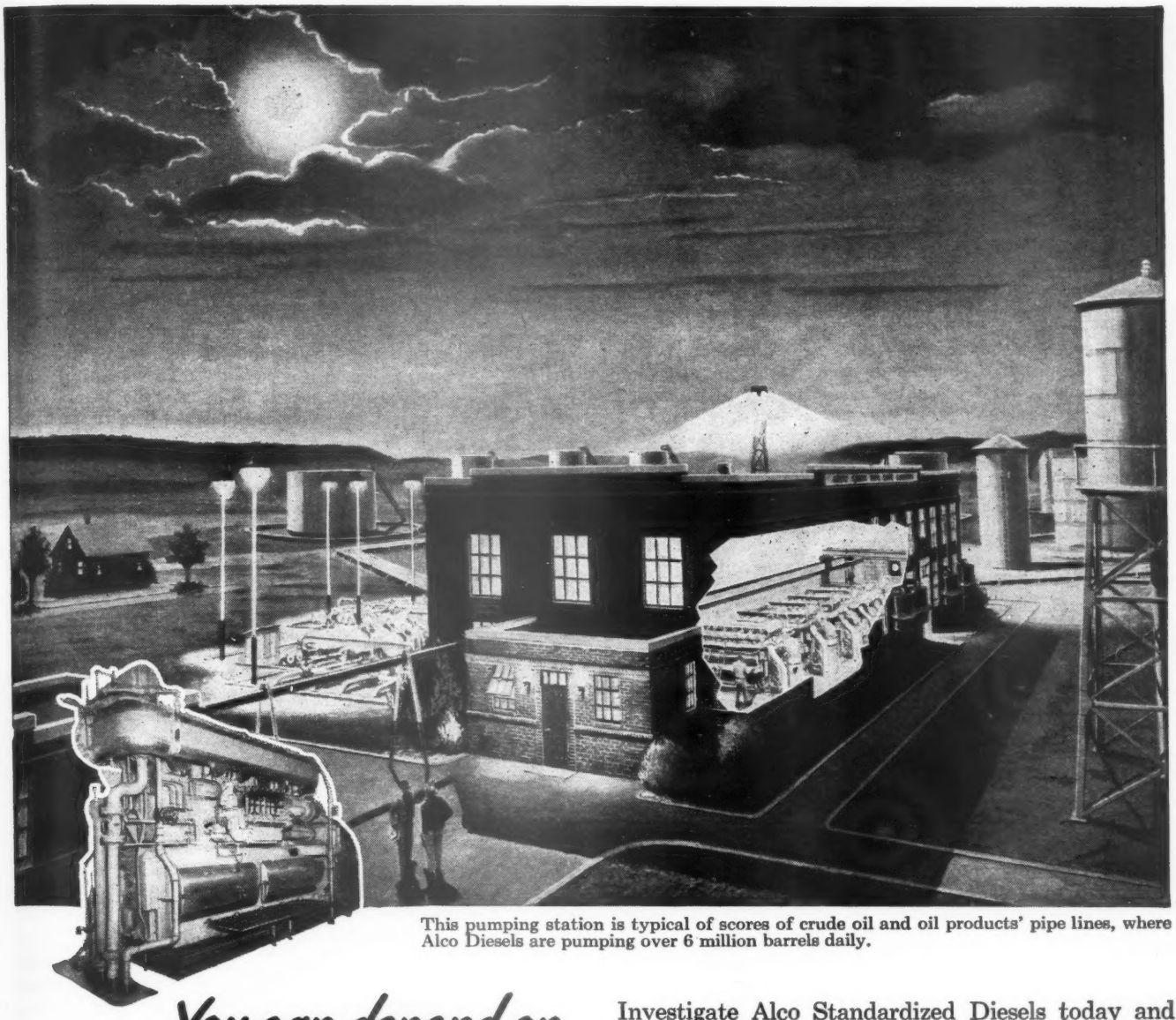

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be carried on over a line that is switched on and off, or using the more technical term, by a series of pulses. Now assume that the "off" position of the switch connects two other people over the line as shown in Fig. 4. Two conversations can be conducted over the line, exactly as the one described before. As far as each line is concerned the switch is being turned on and off at a sufficiently high rate so that the conversation is heard as a continuous sound. Of course it is important to make sure that both switches are synchronized; that is, both are in the "on" position at the same time and in the "off" position at the same time.

This method of dividing the time so that more than one conversation can be conducted over one line is called time multiplexing. It has one very important advantage over the frequency division multiplexing. In time multiplexing only one conversation goes over the line at any one instant. In frequency division, all conversations go over the line at the same time, and consequently a very careful design is necessary to make sure that they don't interfere with one another. In time multiplexing this problems does not exist.

Instead of two conversations over the line, we could transmit eight conversations—using the same principle—with an 8 position switch, as shown in Fig. 5. Of course, in order to attain the "continuous" sound effect, the switch must be rotated 4 times as fast as the two position switch. In the microwave system as many as 23 conversations are carried on in this manner. The speed

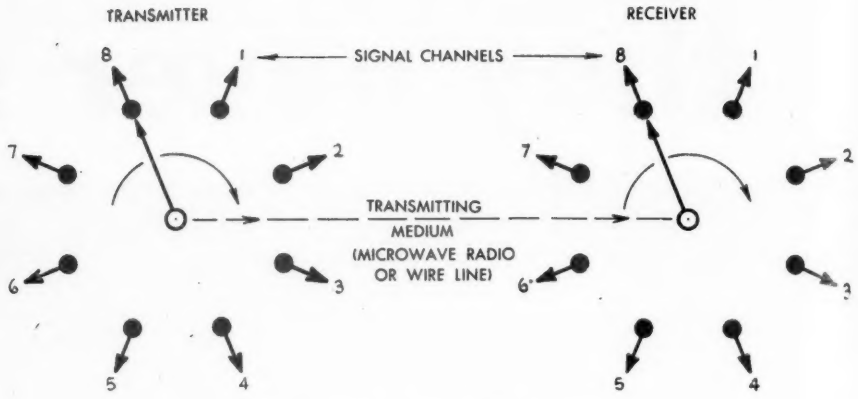


FIG. 5. Simple time multiplex system.

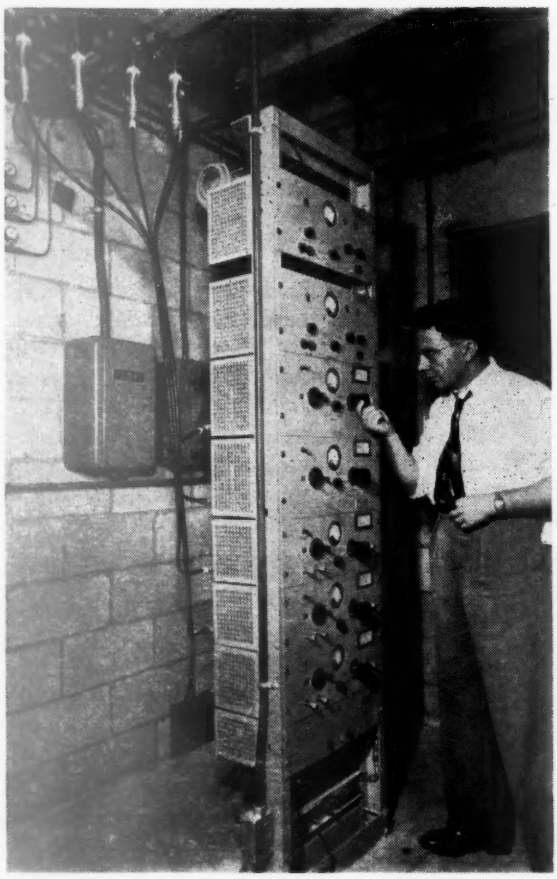
of rotation required for this system is so great that it can be achieved only by an electronic switch. This switch completes each cycle 8000 times a second, or about 100 times faster than any mechanical switch could.

Methods of Modulation

To review briefly, the microwave signal provides the path, multiplexing provides the means of transmitting a number of channels simultaneously, and the modulation provides the means of getting the voice of this path. Four methods of modulation are used in microwave system available today; namely, (1) frequency modulation (FM), (2) pulse amplitude modulation (PAM), (3) pulse time modulation (PTM), and (4) pulse width modulation (PWM).

Usually the frequency modulation is used in frequency division multiplexing systems. In this case the signal composed of all the sub-carrier frequencies, each modulated by an audio signal, is used to change the frequency of the microwave transmitter. This frequency modulated signal is then transmitted in space by the antenna.

When time division multiplexing is used the voice signals must be broken up into a series of pulses. It is convenient therefore to use a pulse modulation system. In pulse amplitude modulation, the height or amplitude of each pulse is varied in accordance with the audio signal as shown in Fig. 6A. In this system the time between pulses and the width of each pulse is constant. In a pulse width system of modulation the width of each pulse is varied in accordance with the modulation as shown in Fig. 6B. In this case the pulse ampli-



Author tuning microwave link installed for Keystone Pipe Line Company.
—Courtesy Federal Telephone and Radio Corporation.

Microwave relay radio equipment mounted on ground in Mid-Valley Pipeline Company installation.
—Courtesy Motorola, Inc.

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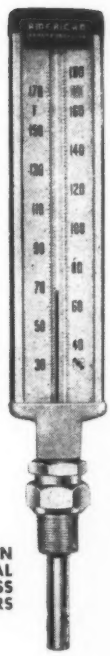

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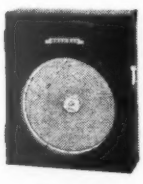

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tude and time between the start of each pulse is kept constant. In pulse time modulation, the pulse amplitude and width are held constant but the time between pulses varies in accordance with the voice signal as shown in Fig. 6C.

Choice of System

As may be surmised from the many methods of multiplexing and modulation used, there is no one system that is best for all applications. Each system has its advantages and disadvantages and the best equipment for any given installation depends to a large degree upon the requirements of the particular pipe line involved.

There are five basic factors that the microwave system engineer considers when designing a link. They are (1) initial cost; (2) operating and maintenance cost; (3) quality of the signal; (4) maximum number of channels to be transmitted over one link; and (5) maximum distance over which the link is to be operated.

Generally speaking it is possible, within certain limits, to reduce initial cost at the expense of day-by-day operating costs and signal quality. A system that is basically designed for short distance communication will be relatively inexpensive when used for short distances and relatively expensive for long distances. Conversely, a link that is basically designed for long distances has a high channel-mile cost if used for short lines, and a low channel mile cost as the full distance capabilities of the link are used. Similar considerations hold for the maximum number of channels that can be transmitted over the link simultaneously.

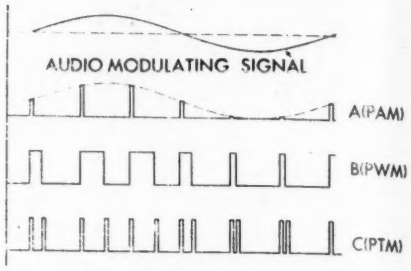


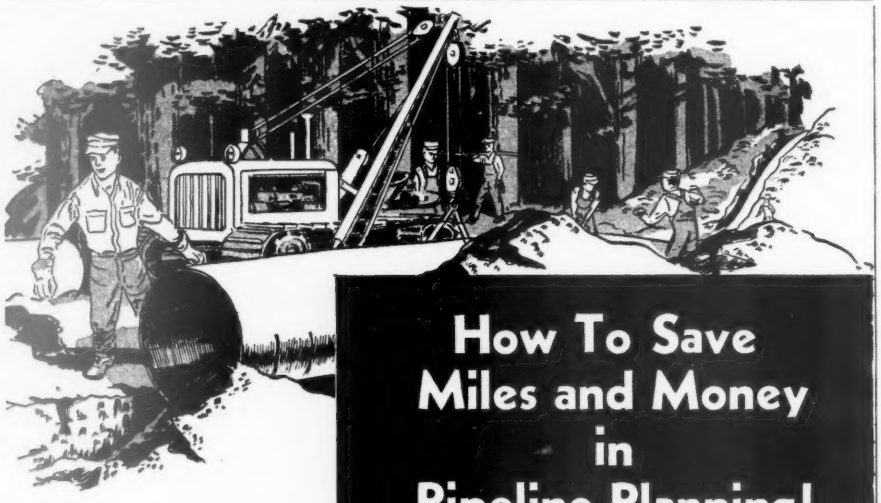
FIG. 6. Methods of pulse modulation.

At the present time, with the demand for links still limited, the trend of microwave equipment manufacturers is to design general purpose equipment, i.e., equipment that will be adaptable to a large variety of applications. Of course each manufacturer has emphasized the features that he believes to be desirable for most installations. Hence, even in these "compromise" versions there are many differences. It is conceivable, however, that as the utilization of microwave radio becomes more extensive, there will be justification for the design of a complete line of equipment to meet more individual requirements. For example, as in carrier equipment, there will be "short" and "long" haul systems capable of transmitting either a small or large number of channels.

Typical Installations

In conclusion the writer would like to note that microwave links have been installed by pipe line companies with great success. The first installation was made by Keystone Pipe Line Company between its central office in Philadelphia and the pumping station at Sinking Springs, Pennsylvania. This link was installed in November 1949, and has been in continuous 24-hr a day service ever since its installation. It has provided reliable communication during this entire period and when a "hurricane" hit Pennsylvania late in November 1950, the microwave system alone rode through the storm without trouble. Similarly, during several ice storms, which disrupted wire lines for weeks, the microwave went on without faltering.

Another early installation of microwave radio was made by the Mid-Valley Pipe Line Company. This link, which is more than 1000 miles long, extends from Longview, Texas, to Lima, Ohio. This system has been in operation since October, 1950, and, as a result of its performance, is now being expanded to provide more communication - service points and channels. * * *



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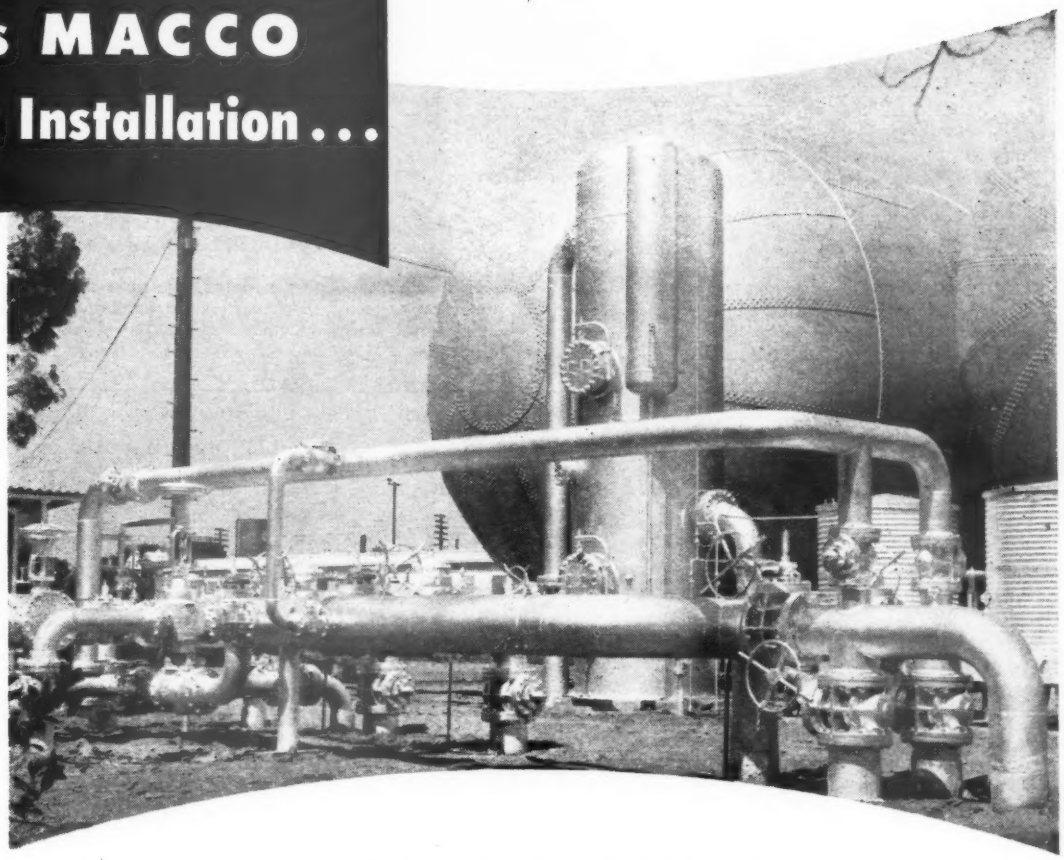

To Macco's field engineers and crewmen, pipeline jobs are not necessarily simply stringing and trenching of pipe as ordered. The piping in the natural gas meter and regulator station shown above is a typical example. With the exception of the storage tanks in the background the entire above-ground system is Macco-engineered and installed. For large or small, simple or complex pipeline jobs on the West Coast — consult MACCO.

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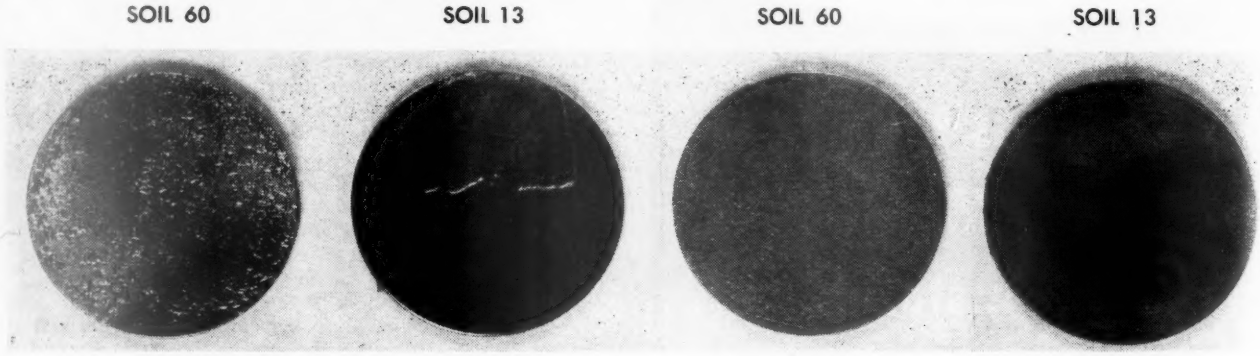

FIG. 1. All four steel specimens were exposed to corrosive soils for 60 days. The first two (control) specimens received no protection, whereas the second two were maintained at a protective potential of —0.77 volt (saturated calomel scale) after 48 hr without protection. Although the control specimens show considerable corrosion, the protected specimens (except for the unprotected period) are virtually undamaged. No. 3 and No. 32 were exposed to a very acid soil (pH 2.9); No. 7 and No. 5 to a very alkaline soil (pH 9.5).

Cathodic Protection of Pipe Underground

National Bureau of Standards finds it can determine by laboratory methods an optimum protective potential

UNDERGROUND corrosion of steel pipe has been estimated to cost $600,000,000 annually in the United States. Efforts to reduce this toll have been stimulated since 1941 by heavy defense requirements for steel and other metals. Workers in the field have learned that underground corrosion can be greatly reduced by cathodic protection techniques, in which the structure is maintained at a suitable negative electrical potential.

A recent study[1] by W. J. Schwerdtfeger and O. N. McDorman of the National Bureau of Standards corrosion laboratory provides a better understanding of the mechanism of this important method of inhibiting underground corrosion. The NBS study centered around laboratory determination of the optimum potential to be maintained for effective protection. By eliminating uncertainties inherent in field measurements, NBS was able to determine an optimum protective potential having a firm scientific basis. The value arrived at — minus 0.77 volt referred to a saturated calomel electrode — was confirmed by weight-loss measurements on electrodes maintained at the selected potential in five corrosive soils.

[1]For further details of this work, see "Potential and Current Requirements for the Cathodic Protection of Steel in Soils," W. J. Schwerdtfeger and O. N. McDorman, *J. Research NBS* 47, 104 (1951) RP 2233.

Normal corrosion of iron and steel underground is largely an electrolytic phenomenon. When iron is exposed to the soil, local differences in electrical potential develop at the surface of the metal, resulting in the formation of numerous small corrosion cells. This means that electric currents flow through the soil from certain areas (anodes) to areas of less negative potential (cathodes), with accompanying loss of metal from the anodes and evolution of hydrogen at the cathodes. When cathodic protection is applied, direct current from an external source is caused to flow through the soil from an auxiliary anode toward the corroding surface. This applied current causes the cathode potentials to approach the anode potentials, and thus reduces the corrosion currents.

The question of the potential at which an underground structure should be maintained in order to inhibit corrosion is of considerable interest. Insufficient potential will give inadequate protection. On the other hand, maintaining a greater potential than is needed is unnecessarily costly, since this requires supplying a larger external current through the resistive earth.

When the potential of a cathodically protected underground structure is measured by engineers in the field, an indefinite IR (voltage) drop is ordinarily included in the measurement. The magnitude of this drop at a given value of current naturally depends upon the conductivity of the soil and the position of the reference electrode used in making the measurement. Corrosion circuits are complex, and there is no general agreement among engineers as to where the reference electrode should be located. A measured value of –0.85 volt (referred to a standard copper-copper sulfate electrode) is generally accepted by engineers as the optimum protective value. Yet because the amount of IR drop is not ordinarily known, identical readings of –0.85 volt obtained by engineers at different installations are not likely to indicate the protective potential free of undesired IR drop.

These uncertainties were eliminated in the NBS laboratory in arriving at the value of –0.77 volt referred to a saturated calomel electrode. As this value corresponds approximately to –0.85 volt referred to the copper-copper sulfate electrode, the NBS work confirms the practice of cathodic protection engineers for the special condition when all IR drop is eliminated except that which is included in the field of the normal corrosion circuits.

To arrive at the optimum protective potential for steel in soils, the potentials of steel electrodes were measured at

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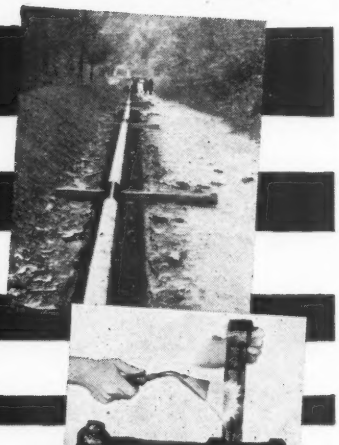

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Originators of the Coal Tar Tape for Pipe Joint Protection

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NBS in 20 air-free soils, ranging from very acid (pH 2.9) to very alkaline (pH 9.6). Potentials were plotted against the pH values of the soils. The resulting curve intersected the potential curve for the standard hydrogen electrode at a pH of approximately 9 and a potential of –0.77 volt (referred to a saturated calomel electrode). This potential was also approximately the most negative value measured. At more negative potentials iron becomes cathodic to the hydrogen electrode, and corrosion therefore ceases.

To confirm experimentally the effectiveness of a –0.77 volt protective potential, weighed steel electrodes were exposed to five soils in specially designed corrosion cells. After two days without protective current, the electrodes were maintained at –0.77 volt for 60 days. By making potential measurements with an electronic interrupter in conjunction with a potentiometric measuring circuit, all IR drop external to the boundary of the corrosion circuit was eliminated. Weight lost during the test by the electrodes maintained at –0.77 volt was negligible compared with weight losses of control electrodes that received no current. Electrodes allowed to deviate for relatively short periods to potentials less negative than –0.77 volt lost appreciable weight, but electrodes maintained at more negative potentials, (–1.0 volt) showed no appreciably greater reduction in weight loss.

The current required to maintain a –0.77 volt protective potential is not uniform. With most of the soils tested, the necessary current diminished to a fairly stable value after about three weeks. These minimum values of current needed to maintain the protective potential differed for different soils, and were about equal to average corrosion currents calculated from weight losses of control (unprotected) electrodes.

It was possible to estimate the minimum protective current initially required for cathodic protection in a particular soil by preliminary measurements. Electrode potentials were measured as increasing values of current were applied. The potential-current curve given by these measurements has a characteristic change-in-slope at a certain current value, above which the potential changes more rapidly. The current indicated by the change-in-slope was taken to be the minimum value initially required for effective protection. This current when constantly applied caused the electrode potential to drift to the protective value (–0.77 volt) in from 3 to 21 days as alkali accumulated on the electrode surface.

Prior to disassembling the corrosion cells, the protected electrodes were left without protective current for about 15 hr, after which a curve relating potential to applied current was again obtained. This time the change-in-slope typical of corroding metals was no longer evident. This was taken as a further indication of the effectiveness of the protection against corrosion provided by the –0.77 volt protective potential. * *

Man carries two 20-ft joints weighing 20 lb each.

Plastic and Glass Fiber Pipe Has New Basic Uses

NEW PIPE CAN WITHSTAND HIGH PRESSURES YET IS LIGHT IN WEIGHT

A new pipe, tough enough to withstand high pressures yet light enough to be carried by a child, impervious to corrosion but flexible enough to be bent by hand is announced by Perrault Brothers Plastic Pipe Division of Tulsa, Oklahoma.

Lewis Perrault, president of the concern, said its development is the result of two years' intensive research by his company.

He described the new product as thermo-setting, glass fiber reinforced, plastic pipe, which is not to be confused with thermo plastic pipe that shatters easily and melts at elevated temperatures.

It will have many applications, Perrault said, including salt water lines, crude oil lines, oil well tubing, gas distribution lines, water distribution systems, oil products lines, irrigation pipe, electrical conduit, and in mines and chemical plants.

"It is not a substitute for cast-iron, steel, or other piping," he emphasized.

"It is superior for some applications," he added. "The new pipe will last forever. It need not be coated, wrapped, or given cathodic protection to keep from rusting. It can be placed by hand or with light machines and joints bent to conform with ditch contours. Once bent they will return to form when released."

A glass smooth interior insures a high flow factor. Moisture absorption is negligible.

It is not affected by temperatures ranging from minus 65 F to plus 300 F. Tests show greater strength at lower temperatures.

Weight is one-fifth that of steel pipe. It has high impact strength and will not conduct electricity.

The cost is slightly more than steel pipe, but mass production plus lessening of resin prices in the future is expected to lower the present cost materially, Perrault said. "It will be a new basic industry," he predicted.

Manufacture has begun at the company's Sand Springs, Oklahoma, plant, which has a capacity of 6000 ft a day.

"We are prepared to expand our facilities when needed," Perrault said.

Two sizes are now being manufactured, 3½ and 4½ in., while 6⅝ and 2⅜ in. are in the process of development.

The 6⅝-in. is being developed in conjunction with the U. S. Corps of Engineers for use as portable pipe.

Joints are 20 ft in length and each size is now manufactured in three wall thicknesses. The lightest joint of 3½-in. weighs 29 lb and will withstand a working pressure of 200 psi while the next with a rating of 400 psi weighs 32 lb. Tubing joints weigh 40 lb.

The weight of 4½ in. is only slightly more, with 200 psi weighing 35 lb; 400 psi, 39 lb, and tubing, 52 lb.

Each type is manufactured in a different color so it may be readily identified.

Collapse rating of the 3½-in. tubing is 1500 psi, and for 4½-in. 1000 psi. Tensile strength is 14,800 to 16,800 psi. Pipe withstands a 40,000 lb pull and coupling threads a 10,000 lb.

Couplings come in several types, detachable with rubber pressure ring, threaded and coupled, permanent chemically welded, and threaded with upset ends.

Manufacture of pipe has been simplified through two years of experimenting during which time Perrault Brothers has applied for approximately 20 patents to cover its processes.

Materials consist of 28 per cent glass fibers, all manufactured by the company, and 72 per cent polyester resins.

The secret of strength lies in 90-deg lamination of fibers in proper directions rather than in "jackstraw" fashion. To achieve a greater bursting strength, for example, fibers are placed around the pipe. For beam strength they are placed lengthways.

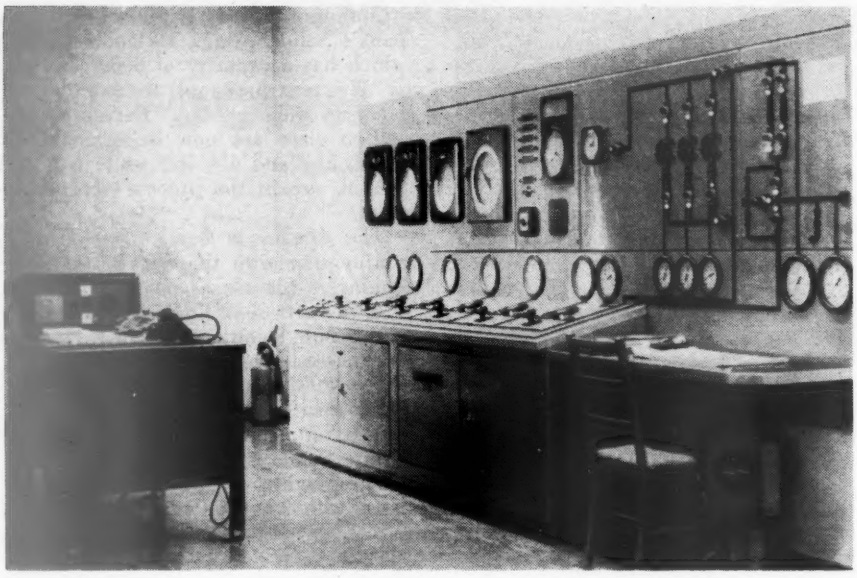
It requires 20 minutes for actual manufacture of a joint, and the process is similar to spinning clothes in a washer.

Fibers are wrapped around a mandril and placed in the spinning machine. The mandril, a rod-shaped tool, is withdrawn and spinning begins, flattening fibers against the interior wall of the machine.

Resins are sprayed inside while spinning continues. Simultaneously the pipe is cured at 200 F. Extra resin is pumped in at the last to insure a mirror finish. Thickness varies less than one-thousandth of an inch, plus or minus 0.02 in.

Perrault Brothers is a large pipe line supply company that also manufactures pipe line coating and wrapping machines.

The company is a partnership between Lewis and Ainslie Perrault. R. E. Shackleford is general manager. Dr. J. D. Robinson, plant manager, formerly was head of the Reinforced Plastics Development Group of the American Cyanamid Company. * * *



Trans-Arabian pipe line control deck.

Helping to Meet the Demand for Fuel

THE fastest growing transportation system lies underground. Pipe lines are increasing fabulously both in length and in size. In the five years 1946-1950 about 46,000 miles of trunk petroleum and gas line have been laid in the United States alone, and 12,000 more are in the construction or planning stage. As of 1950 the world had about 450,000 miles of pipe line (gathering and trunk), equal to 20 times around the earth. Pipe diameters are increasing. The famous Big Inch (24 in.) line of World War fame is no longer the big line. One half of a 550-mile crude oil line to be built to tap the West Texas field by the West Texas Gulf Pipe Line Company will be 26 in. in diameter. Still larger is the Trans-Arabian line built of 30- and 31-in. pipe (nesting one inside the other to save shipping space). An even larger pipe is the 34-in. natural-gas line in California.

The Gulf Pipe Line

The various pipe lines abound with interesting new technical features. The Gulf pipe line, for example, will feature the largest concentration of remote tank-farm pump and manifold valve controls thus far centralized on a control console. On one console will be the control of more than 100 valves and 11 booster pumps. Initially this line will have three pumping stations with 24,000 hp in main-line motor-driven pumps, giving a daily capacity of 300,000 bbl. Booster stations to be added later will raise this to 440,000.

The Plantation Pipe Line

One of the most famous pipe lines, the 1261-mile products line of the Plantation Pipe Line Company built from Louisiana to North Carolina in 1941, has been "double-tracked." The original line was 12 and 10 in. in diameter. On the same right of way with it has been laid an 18 and 14-in. line. The same pumping stations, greatly expanded, are used on the parallel line.

The new Plantation line uses a novel way of measuring pressures. At the various pump locations pressures are measured by Baldwin strain gages. The indications are amplified and transmitted as electrical signals to the control room. Previously this has been done by carrying the refined petroleum in small pipes to the console. Although the constructions with this direct method of measurement have been designed with large safety factors, the presence of flammable products lines in the control room does introduce a hazard. Also the small size pressure pipes sometimes corrode to the point of plugging up. The strain-gage method is no cheaper, but does establish station conditions highly attractive to pipe line operators.

Trans-Arabian Pipe Line

Electrifying pumping stations in the Arabian desert involves more than it does elsewhere. Electrification of the Trans-Arabian stations actually is only one part of the job. The six stations motivating this system average about 165 miles apart across a flat, treeless, arid region without intervening habitations, verging at the western end into a mountainous, sparsely settled terrain. Each station must be made a self-sufficient community. Thus the stations, in addition to housing the pumps, become the heart of a small town and provide the services for it. This includes power plants for all electric power and for lighting, air conditioning, pumping of the precious water supply, and even for the theater and other services necessary to make life pleasant in such isolated areas.

The pumps themselves are engine driven, however, new controls have been built so that pumping operations are handled from a modern, centralized control console in essentially the same way as at the motor-driven stations in this country.

Supervisory Control and Microwave

The men who are in the business of transporting gas and oil in pipe lines have taken a leaf from the book of those who transport kilowatts. This is the control of remote apparatus using supervisory-control equipment. A booster pumping station and a main-line valve of the Pan American Pipeline in Texas will be controlled entirely by an operator in a station 40 and 80 miles away respectively. The supervisory-control system is basically the same as used by electric-power companies for years but the equipment has been modified to be in keeping with pipe line practice. Signals will be interchanged between the control and the controlled stations over a microwave system previously installed for communication purposes. The attendant at the master station will be able to operate all suction and discharge valves at the distant stations, can start and stop each of two pump motors, and can perform other necessary functions. The control also gives him, automatically, several indications of the state of affairs at the two unattended points, even including the presence of hazardous gas in the station buildings, and any abnormal pressures or bearing temperatures. Various pressures and motor currents are telemetered to him continuously. The supervisory-control apparatus even checks itself and the circuit and, if it should become inoperative for any reason, it "says" so. To perform any of the desired operations by the supervisory apparatus, the operator presses buttons exactly as if the equipment were in the next room. All selection and checking of communication circuits is done automatically. * * *

Second Quarter Steel Allotments For Crude and Products Pipe Lines

Sixteen large crude oil pipe lines and five large petroleum products lines in the United States have received priorities assistance from the Petroleum Administration for Defense for the second quarter of 1952, Secretary of the Interior Oscar L. Chapman, Petroleum Administrator for Defense, announces.

Estimated construction cost for the crude oil lines is $243,052,211, and for the products lines $34,356,396, or a total of $277,408,607.

Second quarter allotments for the crude oil lines totaled 218,864 tons of line pipe; for the major products lines, 29,620 tons. An additional 32,097 tons of pipe went to miscellaneous small projects — crude and products — including terminals, small construction, and MRO (maintenance, repair, and operations). Overall the allotments totaled 280,581 tons.

Of the 16 crude oil pipe lines, nine are scheduled for completion in the second quarter of the year, six for the third quarter, and one for the fourth quarter. Two of the products pipe lines are scheduled for completion in the second quarter, two in the third quarter, and one in the fourth.

Total requirements of line pipe for the major projects from their beginning are 781,934 tons.

Crude Oil Lines

Details of the larger crude oil projects follow:

Platte Pipe Line Company—1,080 mi., 16 and 20 in. from Wyoming to Wood River, Illinois. Initial capacity—70,000 bbl per day. Estimated cost—$59,000,000. Estimated completion date—third quarter, 1952.

Total requirements: 140,880 tons.

Second quarter allotment: 33,260 tons.

Sinclair Pipe Line Company—683 mi. 24 and 22-in. from Drumright, Oklahoma, to Salisbury, Missouri, and to Chicago. Initial capacity—280,000 bbl per day. Estimated cost—$51,942,000. Estimated completion date—third quarter 1952.

Total requirements: 144,055 tons.

Second quarter allotment: 62,083 tons.

Cities Service Pipe Line Company—64 miles 18-in. pipe line from Sour Lake, Texas, where it connects with West Texas Gulf, to Lake Charles, Louisiana, and refineries in that area. Initial capacity—150,000 bbl per day. Estimated cost—$3,100,000. Estimated completion date—third quarter 1952.

Total requirements: 8625 tons.

Second quarter allotments: 3100 tons.

Shell Pipe Line Corporation "Rancho"—463 miles 24-in. from McCamey, West Texas, to Houston area. Initial capacity—209,000 bbl per day. Estimated cost—$41,593,000. Estimated completion date—third quarter 1952.

Total requirements: 124,989 tons.

Second quarter allotment: 24,767 tons.

The Texas Pipe Line Company—319 miles 22, 12 and 10-in.—Louisiana Gulf Coast area to Port Arthur, Texas. Initial capacity—145,000 bbl per day. Estimated cost — $18,717,430. Estimated completion date—second quarter 1952.

Total requirements: 54,246 tons.

Second quarter allotments: 3,678 tons.

West Texas Gulf Pipe Line Company—577 miles 26-in. and 20-in. from West Texas to Gulf Coast. Initial capacity—301,000 bbl per day. Estimated cost—$39,057,230. Estimated completion date—Third quarter 1952.

Total requirements: 129,458 tons.

Second quarter allotment: 51,329 tons.

Continental Pipe Line Company—134 miles 12-in. pipe line from Wichita Falls, Texas, to Oklahoma City, Oklahoma, and 16 miles 12-in. loop between Oklahoma City and Ponca City, Oklahoma. Initial capacity 40,000 bbl per day. Estimated cost—$5,839,000. Completion date—Second quarter 1952.

Total requirements: 13,141 tons.

Second quarter allotment: 13,141 tons.

Continental Pipe Line Company—105 miles 8-in.—Rincon Station to Port Isabel, Texas. Initial capacity—17,000 bbl per day. Estimated cost—$1,935,000. Estimated completion date — Second quarter 1952.

Total requirements: 5927 tons.

Second quarter allotments: 2268 tons.

Interstate Oil Pipe Line Company—68 miles foreign made 16-in. and 34 miles 4-in., 6-in. and 12-in. from Louisiana Gulf Coast to the Esso refinery at Baton Rouge. Project is an enlargement of present system. Increased capacity—22,000 bbl per day. Estimated cost—$3,590,000. Estimated completion date—Fouth quarter 1952.

Total requirements: 2435 tons.

Second quarter allotments: 2412 tons.

Sun Pipe Line Company—99 miles 4-in., 6-in. and 8-in. in Scurry County, Texas—a crude feeder to West Texas Gulf. Initial capacity—35,000 bbl per day. Estimated cost—$1,000,000. Estimated completion–Second quarter 1952.

Total requirements: 5540 tons.

Second quarter allotments: 5540 tons.

Service Pipe Line Company — 30 miles 6-in. for gathering system in Knox and Haskell Counties, Texas. Initial capacity—3000 bbl per day. Estimated cost — $487,000. Estimated completion date—Second quarter 1952.

Total requirements: 1521 tons.

Second quarter allotments: 759 tons.

Service Pipe Line Company — 30 miles 10-in.—Lea County, New Mexico. Initial capacity—25,000 bbl per day. Estimated cost — $569,500. Estimated completion date—Second quarter 1952.

Total requirements: 2110 tons.

Second quarter allotments: 2110 tons.

The Texas Pipe Line Company—187 miles 16-in. — Corsicana to Houston tie-in with 20-in. to Port Arthur. Initial capacity—60,000 bbl per day. Estimated cost—$7,878,000. Estimated completion date—Second quarter 1952.

Total requirements: 27,492 tons.

Second quarter allotments: 7492 tons.

Humble Pipe Line Company—New pipe line outlet for the Spraberry field in Upton and Reagan counties of West Texas — 4-in., 6-in., 8-in. and 12-in. Initial capacity—30,000 bbl per day. Estimated cost — $2,173,000. Estimated completion date—Second quarter 1952.

Total requirements: 7575 tons.

Second quarter allotments: 2509 tons.

Service Pipe Line Company—23.5 miles 8-in., 2.7 miles 6-in.; .75 miles 4-in. crude gathering lines in Natrona County, Wyoming. Initial capacity — 6000 bbl per day. Estimated cost—$588,206. Completion—Second quarter 1952.

Total requirements: 1720 tons.

Second quarter allotments: 1333 tons.

Gulf Refining Company—80 miles 24-in. crude line from Midland to Colorado City, Texas, to supply West Texas Gulf Line. Initial capacity—260,000 bbl per day. Estimated cost—$5,582,245. Completion date—Third quarter 1952.

Total requirements: 17,304 tons.

Second quarter allotments: 3083 tons.

Products Pipe Lines

Details of the larger products lines are as follows:

Shell Oil Company—565 miles 14-in. and 8-in.—Wood River, Illinois, to Chicago and Detroit. Initial capacity—85,000 bbl per day. Estimated cost—$15,850,000. Estimated completion date—Third quarter 1952.

Total requirements: 38,588 tons.

Second quarter allotment: 13,165 tons.

Bell Oil and Gas Company — 145 miles 8-in. and 6-in. from Ardmore to Drumright, Oklahoma. Initial capacity —9000 bbl per day. Estimated cost—$3,271,396. Estimated completion date —Second quarter 1952.

Total requirements: 9012 tons.

Second quarter allotments: 956 tons.

The Ohio Oil Company—255 miles 8-in. and 10-in.—East St. Louis, Illinois, to Indianapolis, Indiana. Initial capacity —18,000 bbl per day. Estimated cost—$1,710,000. Estimated completion date —Second quarter 1952.

Total requirements: 4530 tons.

Second quarter allotments: 3399 tons.

Standard Oil Company (Indiana)—316 miles 12-in. from Sugar Creek refinery to Dubuque, Iowa. Initial capacity —40,000 bbl per day. Estimated cost—$10,430,000. Estimated completion date —Fourth quarter 1952.

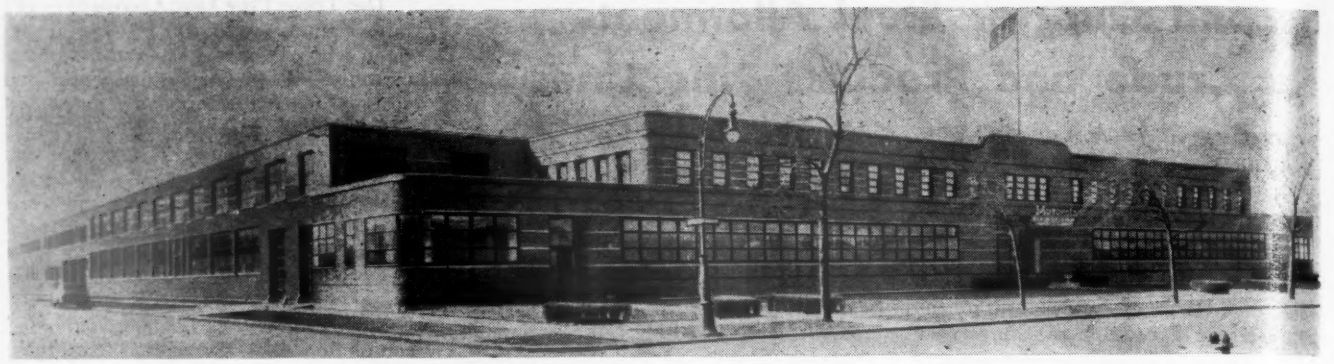
Total requirements: 33,180 tons.

Second quarter allotments: 6000 tons.

Susquehanna Pipe Line Company—120 miles 6-in. and 3½ miles 8-in. from Fosteria to Randolph, Ohio. Initial capacity—17,000 bbl per day. Estimated cost—$3,095,000. Estimated completion date—Third quarter 1952.

Total requirements: 9606 tons.

Second quarter allotments: 6100 tons.



New home of Motorola's Communications and Electronics Division at 4501 Augusta Boulevard, immediately east of the company's main television and radio plant in Chicago. Approximately 1000 persons are employed in the 200,000 sq ft building, which will be used exclusively for 2-way radio production.

Motorola Communications Moved to New Location

Paul V. Galvin, president of Motorola, Inc., has announced the relocation of the company's communications and electronics division.

Formerly operating in the main radio and television plant on Augusta Boulevard in Chicago, the 2-way radio division is now producing from new quarters, immediately adjacent, at 4501 West Augusta Boulevard.

The new building, providing 200,000 sq ft of plant and office space, is the former home of Tropic Aire and the Greyhound Bus Company offices and factory. It has been renovated to consolidate exclusively all activities of the communications and electronics division —2-way mobile and fixed-station radio, microwave relay, and carrier-control engineering, production and sales. Approximately 1000 persons are working in the plant.

Purchase of the new property, for approximately $1,250,000, followed long consideration of a new building exclusively for the communications division and was the result of that organization's natural and continued growth.

The 10-year old building in external appearance is very similar to the television-home set plant in its 2-story construction and streamlined detail.

Name AGA Award Committee

S. B. Irelan, president, Cities Service Oil Company (Delaware), Bartlesville, Oklahoma, has been appointed chairman of the 1952 American Gas Association's distinguished service award committee, it is announced by George F. Mitchell, president, The Peoples Gas Light and Coke Company, Chicago, Illinois, and president of AGA.

This award consists of substantial financial recognition and an engrossed certificate and is given annually to the individual who has made the most outstanding contribution to the advancement of the gas industry.

Members who will serve with Irelan are L. B. Bonnett, vice president, Consolidated Edison Company of New York, Inc., and F. M. Banks, president and general manager, Southern California Gas Company, Los Angeles, California.

Interesting Program for Products Pipe Line Meet

The American Petroleum Institute, Division of Transportation, has announced the tentative list of subjects for the Products Pipe Line Conference in the Blackstone Hotel, Fort Worth, Texas, April 21-23, as follows:

"Description of Dehydration Equipment and Practices on Products Pipe Lines."

"Safety in the Products Pipe Line Industry."

"A Study of the Causes of Pipe Line River Crossing Failures and Methods of Prevention."

"Meter Calibration on Products Pipe Lines."

"Interrelation Between Terminal Design and Operation and Products Pipe Line Deliveries."

"Economic Comparison Between Metering and Tank Gauging of Products Pipe Line Deliveries and Receipts."

"Factors Affecting Conservation Roof Tankage in Products Pipe Line Operations."

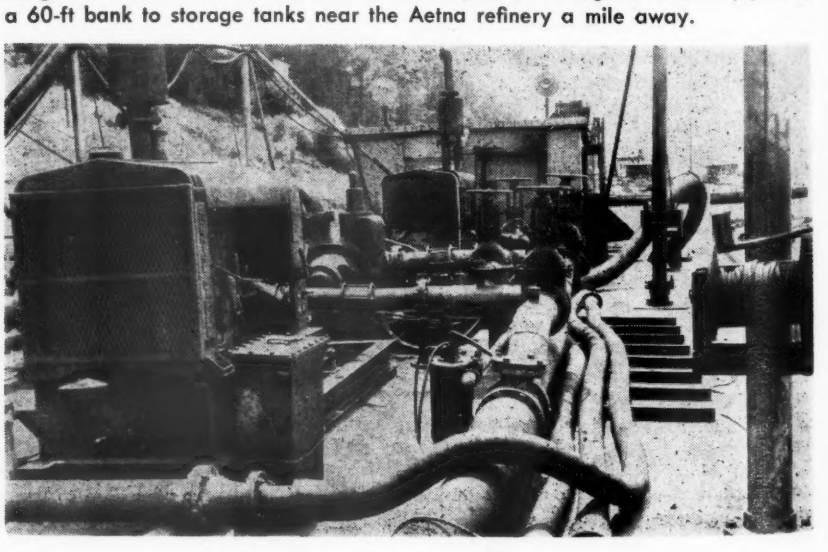
Monday evening, April 21, is being left open to permit those who wish to do so to attend a group session on safety to be held at the Hotel Texas under the auspices of the Safety and Fire Protection Committees of the API.

An all-day field trip has been arranged for Tuesday, April 22, beginning at 7:00 a. m. and returning at 7:00 p. m. Pumping stations of Humble Pipe Line Company and The Texas Pipe Line Company will be visited.

On Wednesday morning, April 23, a panel session, under the guidance of a moderator, and with eight specialists qualified to answer questions submitted by those present, promises to be both interesting and informative. In the afternoon, a field trip will be made to Sinclair's Fort Worth products terminal and Humble's terminal at Dallas. The three-day conference will be concluded with a barbecue dinner to be served at Sinclair's Arlington pump station and terminal.

Reservations should be made directly with the Blackstone Hotel. Fort Worth.

Ohio River Pumping Veterans. These two 150-hp Model HP-600 Cummins diesels have been used since 1940 by Aetna Oil Company, an Ashland Oil and Refining Company affiliate, Louisville, Kentucky, on a pumping barge. Petroleum barges are pushed to Aetna's floating dock and after hose connections are made, the Cummins powered pumps take over. The pumps empty two 9000-bbl barges of crude oil in 11 hours. Crude oil is pushed through 6 or 8-in. pipes, up a 60-ft bank to storage tanks near the Aetna refinery a mile away.



Federal Creates Mobile Communications Department

Establishment of a mobile radio communications department for the design, manufacture, sale, and servicing of a complete line of vehicular and railroad mobile radio equipment is announced by Federal Telephone and Radio Corporation, Clifton, New Jersey, an associate of International Telephone and Telegraph Corporation.

Under the new setup, all mobile radio operations, an activity formerly handled by the Capehart-Farnsworth Corporation, IT&T's associate in Fort Wayne, Indiana, will be centered in Federal's newly acquired plant in Passaic, New Jersey. Production is scheduled to begin early in March with the transfer of all essential machinery, inventories, and personnel.

The mobile radio department will be administered by an experienced staff of Federal and Capehart engineering, sales, and service specialists under the direction of J. J. McDevitt, Jr., who will serve as manager. It will include Ellis Jones, sales manager; Merrill Wilson, service manager; Glen Sellers, chief engineer, and G. Glenn, supervisor of purchasing-production-control, all of Capehart; and Robert H. Kerr and Theodore Osins of Federal, who will serve as test-quality-control inspector and superintendent, respectively.

Shot Service Line in Texas Nears Completion

Construction of 38.5 miles of 10-in. crude oil pipe line from the Cogdell field in southern Kent County to Aspermont in Stonewall County has been started by Service Pipe Line Company.

F. M. Willenburg, Fort Worth, division manager for the company in East Texas, said the Vaughn and Taylor Construction Company of Wichita Falls, Texas, would build the line and that work already is underway.

The new line will be an extension of Service Pipe Line Company's 138-mile line from Aspermont-Old Glory and Jud to Bowie, Texas, that was built during the summer of 1951.

At the company's Cogdell station, the new line will connect with a system built into Post, Garza County, and on into southern Kent County, in 1950. This system, about 82 miles of line, has been moving Kent County and northern Scurry County oil north to the company's West Texas-Drumright line via Slaton. Completion date of the PAD approved project is expected March 15.

Dates Southwestern Short Course Changed

The Southwestern Gas Measurement Short Course at Norman, Oklahoma, will be held May 27, 28, and 29 instead of April 8, 9, and 10, as previously announced. The change was necessitated because of the Navy's occupancy of base facilities at Norman, which required a housing adjustment.

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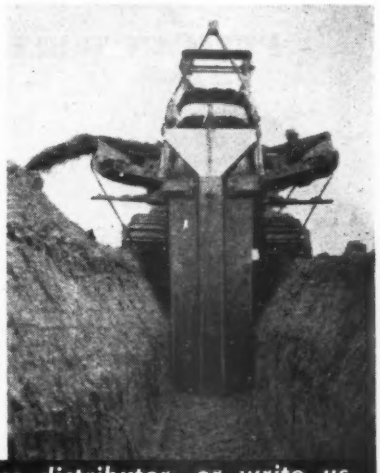

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Three Promoted by Brown and Root, Inc.

The addition of three new vice presidents for Brown & Root, Inc., Houston, Texas, has been announced by Herman Brown, president of the firm.

They are Louis H. Durst, construction manager for the Houston area; G. Hinman, manager of the oil field department, and C. F. Horton, manager of transmission and pipe line projects. The three men are veterans of the Brown & Root organization and represent a total of 60 years with the company.

Durst, whose nickname "Preacher" was acquired at A. & M. College and has stuck with him since, is a native of Crockett, Texas, and has been with Brown & Root since 1928. He organized the company's purchasing department in 1941 and supervised all purchasing of yard machinery and material for the construction of Brown Shipbuilding Company yard, as well as for the Houston Shipbuilding Corporation yard. He has been in charge of most of the miscellaneous construction for Brown & Root in the Houston area.

Hinman, a native of Ranger, Texas, attended Rice Institute from 1931-1932. He played football for the Owls and most football fans will remember him as "Ox" Hinman. He joined Brown & Root in 1933 and is in charge of the company's big department, handling all types of heavy oil field construction both on land and water on the Gulf Coast.

These three veterans of the Brown & Root, Inc. organization have been promoted to vice presidents: Louis H. Durst, left, G. Hinman, and C. F. Horton.

Horton was born in Dallas and received his degree in civil engineering from Massachusetts Institute of Technology in 1930. He joined Brown & Root in 1935 in the road and street department. He spent a year as general engineer in charge of the Caracas, Venezuela, office of Brown & Root and later was project manager of the Kingsville Air Base, Concho Airfield, and the Naval Air Base at McAlister, Oklahoma. Since 1949 he has been manager and in general charge of pipe line work.

C. E. Spahr Succeeds George Wilson with PAD

Charles E. Spahr, who has been deputy director of the Supply and Transportation Division of the Petroleum Administration for Defense, has been named director of the division, Secretary of the Interior Oscar L. Chapman, has announced.

Spahr succeeds George A. Wilson, who has headed the Supply and Transportation Division since June 1951. Wilson has returned to his position as president of the Interstate Natural Gas Company, Inc., New Orleans, Louisiana.

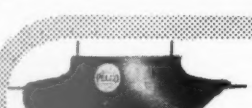
Secretary Chapman also announced the appointment of Wilson to membership on the Gas Industry Advisory Council for the remainder of 1952. Wilson served on the 1951 council up to the time he joined PAD's staff.

Before joining PAD in January, Spahr was vice president in charge of the transportation department of the Standard Oil Company (Ohio), with headquarters at Cleveland. After working for the Standard Oil Company (Indiana) and Phillips Petroleum Company, Spahr joined the Standard Oil Company (Ohio) in 1939 as an engineer on design and construction of pipe lines, terminals, and pumping stations.

During World War II he served in the Army Corps of Engineers and was one of the engineering officers responsible for construction of the petroleum products pipe line built across the Himalayan Mountains from Calcutta, India, into Burma. At the time of his release from active duty in 1945 he held the rank of major.

Returning to the Standard Oil Company (Ohio) after the war, Spahr served as industrial relations assistant, assistant to the vice president in charge of transportation, manager of the department in September, 1950, and was named vice president in charge of transportation in May, 1951.

Spahr, who will serve in his new post without compensation, holds BS and CE degrees from the University of Kansas.



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Planning Begins for AGA Convention

Initial planning has begun for the 34th Annual Convention of the American Gas Association. The convention, together with an exhibit by the Gas Appliance Manufacturers Association, will be held in Atlantic City, New Jersey, October 27-30.

F. A. Lydecker, vice president, Public Service Electric and Gas Company, has been appointed chairman of the general convention committee by George F. Mitchell, president of AGA. Industry executives who will assist Lydecker in arranging the general plans for the four-day meeting are: Henry A. Eddins, vice president, Laclede Gas Company, St. Louis, Missouri; N. Henry Gellert, president, Seattle Gas Company, Seattle, Washington; E. L. Henderson, vice president, United Gas Corporation, Shreveport, Louisiana; Carl H. Horne, manager, major appliance division, Rheem Manufacturing Company, New York, New York, and W. M. Jacobs, vice president, Southern California Gas Company, Los Angeles, California.

Also members of the general convention committee are: Jesse L. Johnson, vice president, Providence Gas Company, Providence, Rhode Island; F. X. Mettenet, vice president, The Peoples Gas Light and Coke Company, Chicago, Illinois; Earl Smith, president, South Jersey Gas Company, Atlantic City, New Jersey; Frank H. Trenbly, Jr., vice president, The Philadelphia Gas Works Company, Philadelphia, Pennsylvania, and C. H. Zachry, president, Southern Union Gas Company, Dallas, Texas.

Arrangements have been made by the exhibit committee of the Gas Appliance Manufacturers Association, which promise that this biennial feature will be one of the finest exhibitions of gas appliances and equipment ever shown at a gas industry convention.

One of the responsibilities of the AGA general convention committee is the arranging of inspirational and informative programs for the general sessions. An imposing array of talent will be enlisted for these meetings. Sectional committees also are working to assure attractive and productive meetings for the individual sections. The entertainment committee will arrange a program of recreation that will appeal to the thousands of delegates and guests expected at the convention.

Member companies are being asked to make applications for hotel accommodations as soon as possible to the American Gas Association Housing Bureau, 16 Central Pier, Atlantic City, New Jersey.

North Dakota's First Pipe Line Now Moving Oil

Regular shipment by pipe line and rail of North Dakota crude oil to refining centers began from Tioga, North Dakota, the early part of February.

An event of historical and economic interest to the state, the first regular shipment by the Service Pipe Line Company and Great Northern Railroad heralds the beginning of a promising new industry. The oil was produced by the Amerada Petroleum Corporation, and consigned to the Northwestern Refining Company at Minneapolis.

Service Pipe Line Company has completed construction of a gathering system in the Beaver Lodge field of the Tioga area of Williams County capable of pumping about 18,000 bbl of oil a day. Affording connections to all wells in the Beaver Lodge area, the line terminates at a 12-car loading rack at Tioga.

Despite bitter weather and material shortages, the company this winter laid almost 11 miles of 6-in. and almost 4 miles of 4-in. pipe to connect the wells with the railroad. The pipe line, North Dakota's first, greatly increases the probability of other wells being drilled and the field developing into a good producing area.

PAD Summarizes Line Pipe Allocation Under CMP

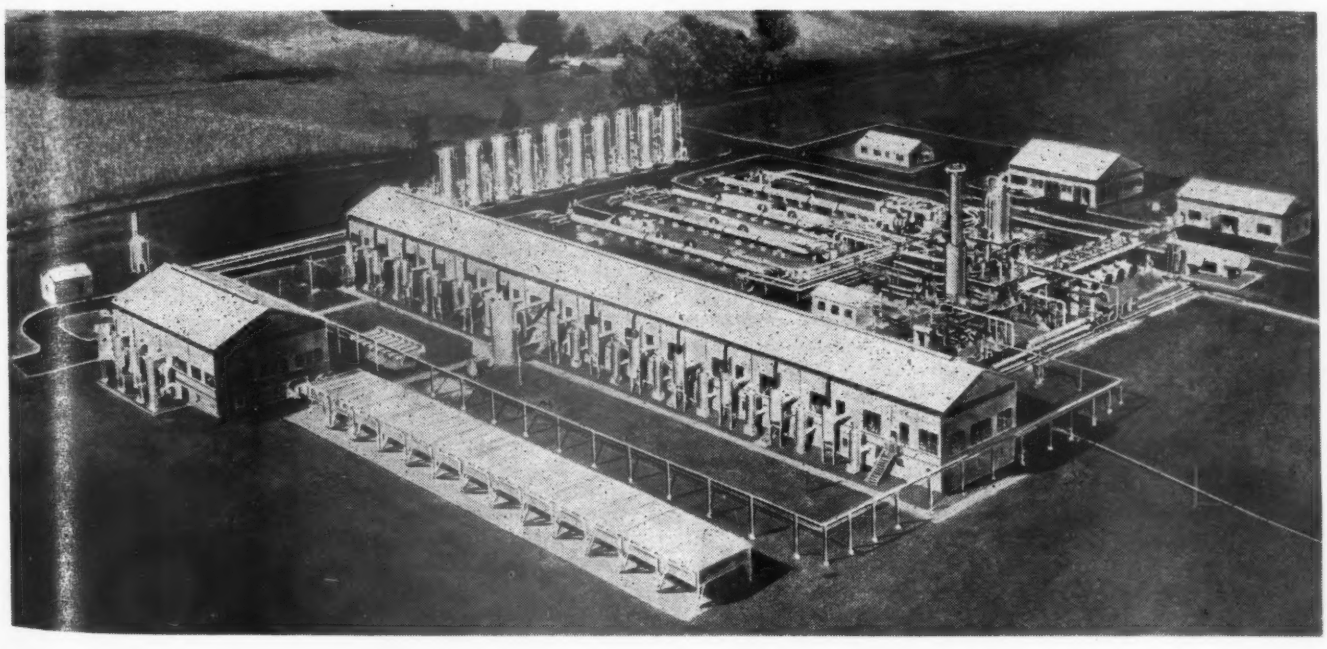
Total allocations of 2,435,370 tons of line pipe for oil transportation and gas transmission have been made by the Petroleum Administration for Defense in the first four quarters under the Controlled Materials Plan, Deputy Petroleum Administrator Bruce K. Brown states. The period covers the last half of 1951 and the first half of 1952.

Of the total 870,447 tons have gone to oil lines and 1,564,923 tons to gas lines.

In some cases companies have not been able to place their orders for line pipe during the quarter for which the allotment was first made; they have then had to ask PAD for a revalidation of the allotment in a later quarter. Accurate tabulation of such revalidation requests is practically impossible, as the figures shift from day to day. Consequently the data in the following tabulation are based on the original allotments only and do not reflect the tonnage of pipe actually shipped by the mills in each of the quarters.

	1951		1952		Total to date
	3rd Qtr.	4th Qtr.	1st Qtr.	2nd Qtr.	
Oil.....	81,047	193,870	314,949	280,581	870,447
Gas.....	469,944	460,829	326,650	307,500	1,564,923
Total.....	550,991	654,699	641,599	588,081	2,435,370

Aerial view of Tennessee Gas Transmission Company's hydrocarbon extraction plant near Greensburg, Kentucky. Complete article on installation begins on page D-3 of this issue.



Gas Lines Allotted 305,500 Tons Steel Second Quarter

Five major natural gas pipe line projects with a total estimated construction cost of $307,776,500 have been given priorities assistance by the Petroleum Administration for Defense for the second quarter of 1952, Secretary of the Interior Oscar L. Chapman announces. In addition a large number of smaller gas projects also have been given assistance, he said.

There were 174,520 tons of pipe in diameters of 16 in. and over allocated for the second quarter to the five major projects. Most of these have been under construction since 1951, and they called for 708,300 tons of line pipe for completion from their beginning.

An additional 132,908 tons of pipe have been allocated to several hundred projects, including gathering lines, distribution lines, other smaller gas projects and MRO (maintenance, repair, and operations).

Total pipe allocated to date for the quarter is 307,500 tons.

The five large projects given priorities assistance, according to Deputy Petroleum Administrator Bruce K. Brown, are:

1. Extension of the existing Gulf Coast-Buffalo pipe line of the Tennessee Gas Transmission Company to the New York-Massachusetts line, together with loops to increase the capacity of the line, which will increase supplies to the critical Appalachian region and northward.

2. Lines of the United Gas Pipe Line Company, with a total length of 1018 miles, from the Gulf Coast to Kosciusko, Mississippi, and Monroe, Louisiana, which will make almost 1 billion cubic feet of gas a day available to long pipe lines stretching into the East and Middle West.

3. The 826-mile line of the Texas Eastern Transmission Corporation from Kosciusko, Mississippi, to Connellsville, Pennsylvania, which will supply the Appalachian region and at a later date transport gas for distribution in New England.

4. Extension and looping Texas-Ohio system of the Texas Gas Transmission Corporation to provide additional supply to present customers.

5. The 100-mile line of the Lone Star Gas Company from storage fields to the Dallas-Fort Worth area.

Details of the five major projects given priorities assistance for the second quarter are the following:

PROJECTS ALLOTED PIPE.

Company	Estimated cost	Estimated completion date	Capacity cu ft/day	2nd Q '52 line pipe required
Texas Eastern Trans. Corp.	$74,815,000	2nd Q '52	382,000,000	13,300
Tennessee Gas Trans. Co.	64,540,000	2nd Q '52	250,000,000	63,720
United Gas Pipeline	116,500,000	3rd Q '52	920,000,000	61,000
Texas Gas Trans. Corp.	46,126,000	3rd Q '52	260,000,000	25,000
Lone Star Gas Co.	5,795,500	3rd Q '52	105,000,000	11,500
Total major projects	$307,776,500		1,917,000,000	174,520
Other projects	—	—	—	132,980
Total line pipe allocations second quarter 1952	—	—	—	307,500

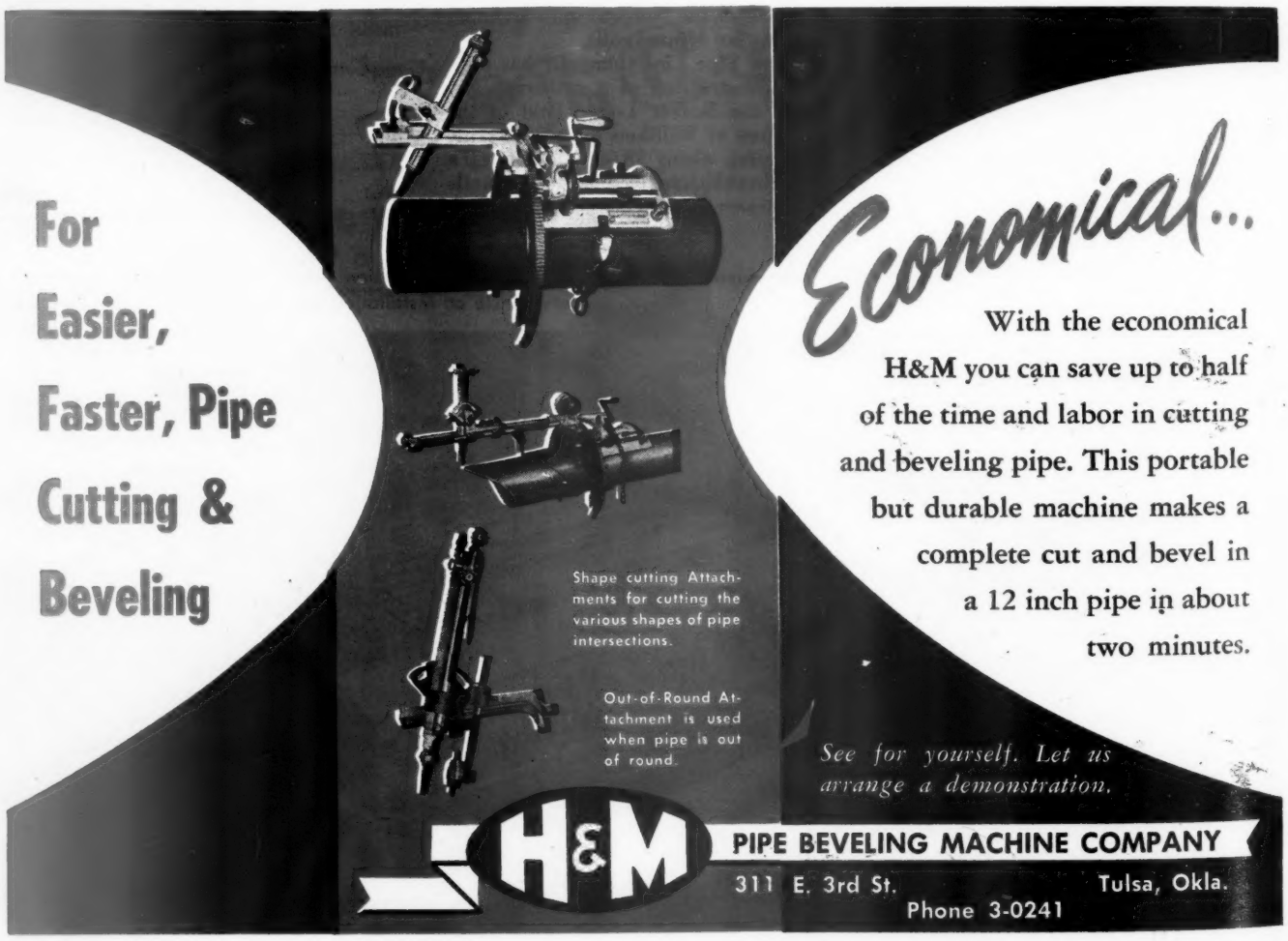
Conference Held On Gas Hydrate Control

Four papers that drew lively discussion from 196 gas industry representatives at the recent University of Oklahoma conference on gas hydrate control will be published, according to Laurence S. Reid, chairman of University's School of Natural Gas Engineering.

Participants in the conference came from California, Pennsylvania, Montana, Mississippi, and Michigan as well as the Middle West and Southwest.

The papers to be published were presented by Dr. John M. Campbell of Black Sivalls and Bryson, Inc., Oklahoma City; E. Paul Wilkinson, Magnolia Petroleum Company, Dallas; J. H. Sullivan, Atlantic Refining Company, Dallas, and R. M. Woolfolk, The California Company, Ruston, Louisiana.

Conference participants also heard Carl E. Cloud of Tulsa, general superintendent of the Oklahoma Natural Gas Company, describe problems of underground gas storage reservoirs.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PIPE LINE PERSONALS

Everett O. Stoothoff has been appointed assistant to the secretary of Texas Gas Transmission Corporation, it was announced by W. T. Stevenson, president.

Stoothoff, formerly with Chemical Bank and Trust Company of New York

E. O. Stoothoff

City, will be responsible for the minutes and other corporate records.

A native of Brooklyn, Stoothoff is a graduate of Colgate University, with a bachelor of science degree. He has a trust certificate from the American Institute of Banking and attended New York University School of Law.

Charles E. Curry has been promoted to senior superintendent of the newly created Tri-State Division of Sohio Pipe Line Company. The new division is a consolidation of the Mt. Vernon and Grayville divisions. Headquarters of the Tri-State Division will be at Mt. Vernon, Illinois.

C. C. Bledsoe, secretary-treasurer of Midwestern Constructors, Inc., Tulsa, Oklahoma, addressed The Pipe Liners Club of Tulsa at the February meeting on the subject "The Pipe Line Contractors Viewpoint of the Owners and Their Employees."

George L. Dye has been named division right-of-way man for the Service Pipe Line Company, J. E. Polston, division manager, has announced. He replaces **Frank O. Rudy** who retired under the company's retirement plan.

Educated in Tulsa, Dye joined Service Pipe Line in 1946 after serving three years with the U. S. Merchant Marines. Earlier he was employed in pipe line and construction work.

H. G. Mariner, Missouri division manager for Service Pipe Line Company, is attending the 19th advanced management program of the Harvard Graduate School of Business Administration, which began February 28.

The intensive, twelve and a half week course is for top executives. A typical class numbers 140 men selected to attend by 100 companies.

In Mariner's absence **J.J. Willenburg,** Galesburg, Illinois, Illinois division manager, will direct operations.

Sigurd Vikesdal, superintendent of operations at the Liberal, Kansas, compressor station of Northern Natural Gas Company, has been appointed superintendent of the Hugoton station. He began work with Northern Natural in August, 1935, and has been a superintendent since 1946.

G. T. Studebaker, assistant superintendent of the Skellytown compressor station since 1948, becomes superintendent at Liberal. He has been in the employ of the company since March 4, 1936.

J. L. Mills, master mechanic at Skellytown, is now assistant superintendent of the compressor station at that point. He has been with the company since May 19, 1937.

Gene Funnell, master mechanic at Welcome compressor station, has been named assistant superintendent at Hugoton. He has been with the company continuously since August 13, 1935.

C. B. Barker, pipe line maintenance foreman at Port Neches, Texas, for Shell Pipe Line Corporation, has been transferred to the Gohlke field.

G. C. Roberts, assistant district gager at Roberts, has been made station chief engineer at Driver.

A. E. Slayter, field gager at Livingston, Texas, is now district gager for the McCoy-Cleveland area.

R. M. Stell, district telephone maintenance foreman, has been transferred from Wink to Wichita Falls.

H. H. Williams, district gager of the McCoy-Cleveland area, has been transferred to the Gohlke field.

Hiram J. Carson, at his request, has been granted a leave of absence by Northern Natural Gas Company and has resigned his position as first vice president and director of Northern and as director of the subsidiary company, Peoples Natural Gas Company. Carson reaches his normal retirement date on December 1, 1952, and the leave of absence will be effective until such time.

He has been in the electric and gas industry since 1911. Following his graduation from Iowa State, he became a cadet engineer with Peoples Light Company of Davenport, Iowa, then to Muscatine, Iowa, where he became general superintendent of the Gas and Electric Company there. He became general manager of the Cedar Rapids Gas Company in 1915 and was in the army for two years during World War I and upon his return resumed his position as general manager of the gas company at Cedar Rapids, Iowa.

Carson joined Northern in 1930, the year in which the company was incorporated. In the earlier years of Northern he devoted his energies to building up desperately needed loads on the system. He has had general supervision of the development of Northern's system

Hiram J. Carson

from a capacity of about 80,000,000 cu ft a day to the present 675,000,000. He believes Northern's operating, maintenance, engineering, and construction organization has the highest morale, faithfulness, and competence of any in the country. He was chairman of the rate and engineering committees and served as chief engineer, superintendent of operations, vice president, vice president in charge of operations, and first vice president. He has been a director of Northern and Peoples since 1942.

Carson has had a long and distinguished career in the natural gas industry. He is well known for his work in the fields of dehydration, hydrogen sulphide removal, and the all-welded large diameter pipe line. He put his conclusions on these subjects to work for Northern and these were highly successful and satisfactory. In turn, the natural gas industry applied them extensively.

Last fall he received the American Gas Association's Distinguished Service Award for his contributions toward the advancement of the natural gas industry. This is the highest honor bestowed in the industry.

During World War II Carson was asked to represent the natural gas industry on the War Production Board in Washington, D. C., which he declined for personal reasons.

He has represented the gas industry as president of the Midwest Gas Association, also as chairman of the Midwest Natural Gas Supply Committee for the War Production Board, chairman of the American Gas Association Transmission Committee for three years, chairman of the Nitrogen Removal Committee of the AGA and as a member of the Technical and Research Committee of the AGA.

Mr. and Mrs. Carson are moving, temporarily, to Berkeley, California.

PIPE LINE PROJECTS

FPC Authorizes Construction Costing $86,498,922

The Federal Power Commission during the last six months of 1951 authorized construction of natural gas transmission facilities that will add more than 350,000,000 cu ft of daily delivery capacity to the nation's individual pipe line systems, Chairman Thomas C. Buchanan announces.

Chairman Buchanan said the new facilities authorized during this six-month period involve 1463 miles of natural gas pipe line and have an estimated total construction cost of $86,498,922.

Approximately $75,858,103 of the total construction cost was for major projects, estimated to cost $700,000 or more each. These larger projects are expected to benefit 88 cities of 50,000 population or more in 18 states and the District of Columbia, as well as numerous smaller communities.

The daily capacity of the individual pipe line systems involved will be increased by at least 325,000,000 cu ft of gas through these major projects, which include construction of a total of approximately 1059 miles of new pipe line and installation of compressor facilities aggregating 79,030 hp.

The largest single authorization dollarwise during the six-month period was for El Paso Natural Gas Company, of El Paso, Texas, to expand its system capacity by construction of an additional 10 miles of 30-in. loop pipe line on its system in Texas and by installing a total of 56,070 additional compressor horsepower in main line and booster stations in Texas, New Mexico, and Arizona. The El Paso project, estimated to cost $23,400,000, will deliver 100,000,000 cu ft of natural gas per day to meet increased requirements of existing markets in Texas, New Mexico and Arizona—particularly the Phoenix, Arizona, area.

During the calendar year 1951, the commission authorized construction of a total of 6091 miles of pipe line and installation of compressor units aggregating 426,500 hp. Total estimated construction cost is $471,383,184. Major projects costing $700,000 or more authorized during the calendar year involve a total estimated construction cost of $454,657,645 and include 5589 miles of pipe line and installation of 405,875 hp in compressor units. These major projects will add more than 2¼ billion cu ft of daily delivery to the individual pipe line systems involved.

Since February 7, 1942 (the date when the present certificate provisions of the Natural Gas Act became effective), the commission has authorized a total of more than 43,800 miles of pipe line and 2,851,000 hp in compressor units. The facilities authorized since 1942 are estimated to cost nearly 3 billion dollars and are designed to add more than 16 billion cu ft of daily delivery to the nation's individual pipe line systems.

8695 Miles Gas Lines Authorized in 1951

The Federal Power Commission has announced the issuance of its 31st annual report covering the fiscal year ended June 30, 1951.

The report describes the fiscal period as one of the "most active" in the commission's 31-year history as a governmental establishment, with its regulatory role in connection with the natural gas and electric power industries assuming "even greater significance" in the economic welfare of the nation.

The commission reported that the tremendous growth of the electric power and natural gas industries, which first became manifest in the period immediately following World War II, continued throughout the fiscal year 1951 as huge new expansion programs were planned and carried forward to meet both civilian needs and the mounting defense requirements.

The report notes that many previous records were shattered as greater amounts of electric energy were produced and more natural gas moved through the ever-spreading network of interstate pipe lines. The electric utility industry added approximately 5,819,000 kw of installed capacity in the calendar year 1950 to generate a record 329 billion kw-hr of electric energy, the commission stated.

The natural gas industry, meanwhile, transported approximately 2000 billion cu ft through its interstate lines during the same period. At the same time, the amount of installed capacity involved in hydroelectric projects under FPC license rose to a record 7,041,000 hp, a gain of 471,000 hp over the previous year.

During the fiscal year 1951, the commission authorized construction of natural gas facilities estimated to cost a total of $725,432,984, and involving 8695 miles of pipe line and 736,135 in compressor hp. The major new market areas to be opened up to natural gas through FPC authorizations during the fiscal period included New England, the Piedmont area of the Carolinas, and the Albany-Troy area of New York.

California-Texas Crude Oil Line Prospects Bright

Construction of a West Texas to California crude oil pipe line is expected to be given government approval sometime after the middle of the year. The need for more crude in California, and the adequacy of West Texas production, are agreed upon by officials. PAD, which will make the final decision, apparently believes that the completion of 16 other crude oil lines during the next six months will release sufficient line pipe to make the West Texas-West Coast project feasible.

Two companies have asked to be allowed to construct the line and it will have to be decided which shall be permitted to do so. The Progress Pacific Pipe Line Company has its headquarters in Los Angeles, California, and the West Coast Pipe Line Company in Dallas, Texas.

The Dallas company's application is for a 1100-mile, 20-in. line from Snyder, Texas, to Norwalk, California. It would cost approximately $60,000,000 and would have an initial capacity of 200,000 bbl a day. The Progress Pacific line would extend from Odessa, Texas, to Los Angeles.

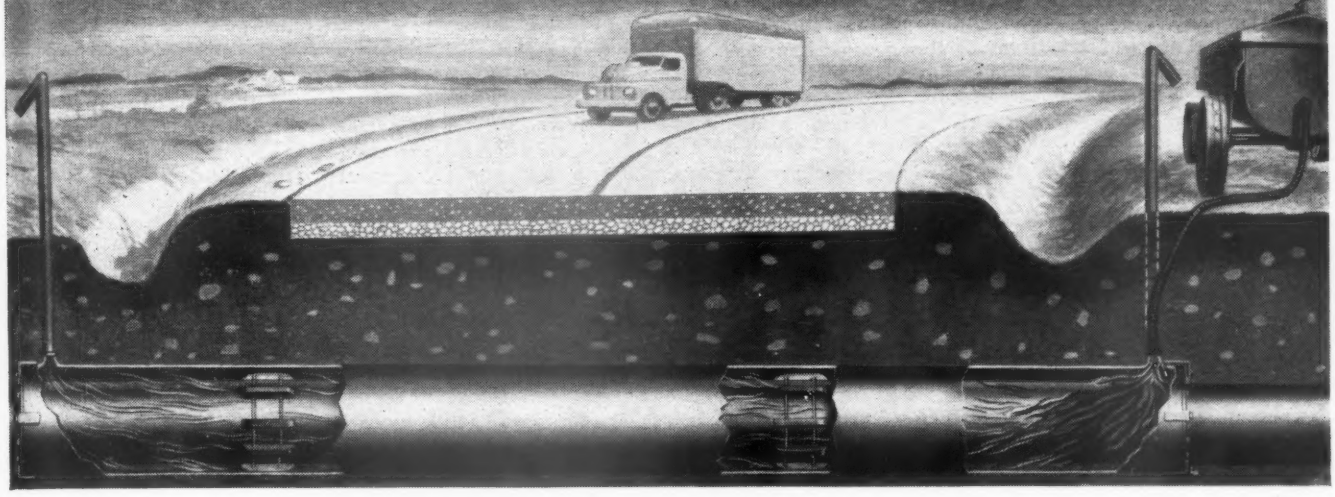
Exchange of Natural Gas Is Approved

The Federal Power Commission has approved a plan for the exchange of natural gas during temporary periods of emergency on the pipe line systems of Texas Eastern Transmission Corporation, of Shreveport, Louisiana, and Transcontinental Gas Pipe Line Corporation, of Houston, Texas.

Under the authorization, Texas Eastern will construct inter-connecting and metering equipment, estimated to cost $6500, at a point where the main transmission lines of the two companies cross near Beaumont, Texas. The interconnection will permit the exchange of 60,000,000 cu ft of gas per day by either company with the other.

The two companies also were authorized to make emergency deliveries to Philadelphia Electric Company and the Philadelphia Gas Works Company, both of Philadelphia, Pennsylvania, and the Public Service Electric and Gas Company, of Newark, New Jersey, all three of which now receive natural gas from both Texas Eastern and Transcontinental. In times of emergency on either the Texas Eastern or Transcontinental systems, gas will be delivered to these consumers by the other company for the account of the company experiencing the emergency.

For Cased Pipe Line Crossings NO-OX-ID Casing Filler PROVIDES SUPERIOR PROTECTION



Wherever pipe lines are cased beneath highways and railroad crossings, NO-OX-ID C-M Casing Filler in the annular space provides superior protection against corrosion because it is *not* just an oil or petroleum product . . . it's a high grade *rust* preventive that:

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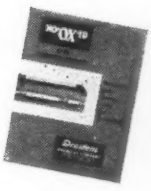

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Continental and Sinclair To Build 310-Mile Line

Plans for construction of a new 8-in. products pipe line from Sinclair, Wyoming, to Salt Lake City, Utah, have been announced by L. F. McCollum, president of Continental Oil Company, and P. C. Spencer, president of Sinclair Oil Corporation.

The new line will be about 310 miles in length, and will cost approximately $8,000,000, it was said.

Pioneer Pipe Line Company has been formed to build and operate the line, the capital stock of which will be owned 65 per cent by Continental Oil Company and 35 per cent by Sinclair Pipe Line Company.

The initial carrying capacity of the new products line will be 12,000 bbl daily and it is estimated that approximately 100,000 bbl of products will be required for line fill alone.

The plans provide for construction at Salt Lake City of a products terminal and storage facilities for approximately 500,000 bbl of products. At the terminal there will be a 10-car loading rack for tank cars and a 4-position truck loading rack with facilities for loading at the maximum rate of 2500 bbl of products an hour. It is estimated that the new terminal will cost about $1,000,000. It is contemplated that the new line when completed will tie in with the Salt Lake Pipe Line Company's line, which extends from Salt Lake City to a point on the Columbia River in Washington.

U. S. Gives Permission To Import Canadian Gas

The Federal Power Commission has authorized the Montana Power Company, of Butte, Montana, to import up to 10 billion cu ft of natural gas annually from Canada, to be used exclusively to render service to the Anaconda Copper Mining Company.

Under the authorization, Montana Power may import up to 40 million cu ft of gas daily. The authorization expires April 7, 1956.

A Presidential Permit covering the maintenance and connection at the U. S.-Canadian border of facilities for the importation of the gas has been sent to the company.

Montana Power will import the gas from fields in the Pakowki Lake area in southeastern Alberta. The gas is to be produced and transmitted in Canada by two subsidiaries of Montana Power — Canadian-Montana Gas Company, Ltd., and Canadian-Montana Pipe Line Company.

The facilities to be used in importing the gas include about 21.7 miles of 16-in. line extending from the Pakowki Lake area to a point on the Canadian-Montana border, and approximately 52.3 miles of 16-in. line extending from that point to a connection with Montana Power's existing system near Cut Bank, Montana. The 21.7 miles of line in Canada will be owned and operated by Canadian-Montana Pipe Line Company.

Pacific Northwest Gas Hearing Begins April 18

The Federal Power Commission has scheduled a consolidated hearing to begin April 8 in Washington, D. C., on four applications that propose the importation of natural gas from Canada to serve market areas in the Pacific Northwest for the first time.

The applications are by Northwest Natural Gas Company, of New York City; Pacific Northwest Pipeline Corporation, of Houston, Texas; Westcoast Transmission Company, Inc., of Wilmington, Delaware, and Glacier Gas Company, of Butte, Montana. None of the companies presently operate natural gas pipe line facilities.

Northwest Natural Gas Company is proposing to build a pipe line system, with a maximum daily delivery capacity of 285,000,000 cu ft, to transport natural gas from Canada to markets in Idaho, Washington, and Oregon, with a portion to be returned to Canada for use in British Columbia.

Estimated cost of the project, including facilities in Canada, is $92,000,000. The project would include 645 miles of main pipe line, various lateral lines, and four compressor stations with a total of 24,750 hp. The natural gas that Northwest proposes to import would be gathered and transported in Alberta by two subsidiaries.

Pacific Northwest Pipeline Corporation is planning a project, estimated to cost $174,186,602, which would link the Texas gas reserve areas with gas fields in Alberta. The company proposes to build a 2175-mile pipe line system from Texas to the State of Washington. This line would have an initial capacity of 250,000,000 cu ft a day. Pacific Northwest also plans to purchase about 100,000,000 cu ft daily, which would be imported from Alberta. In addition to the Texas-to-Washington line, the project would include about 400 miles of lateral pipe lines and approximately 83,200 in compressor horsepower. Markets would include areas of Utah, Idaho, Washington, Oregon, and British Columbia.

Westcoast Transmission Company is seeking authority to build about 615 miles of pipe line to supply markets in Oregon and Washington. The proposed project, estimated to cost $25,690,000, would have a designed capacity of 221,000,000 cu ft of natural gas a day in the fifth year of operation. The gas would be imported from Alberta, where it would be transported to the U. S.-Canadian border by an affiliate.

Glacier Gas Company is proposing to build a 626-mile pipe line system to transport gas imported from Alberta to markets in Montana, Idaho, and Washington. The company did not give any estimate of the cost of the project, which would carry a maximum of 25 billion cu ft of gas annually from Alberta to the United States markets.

Nevada Natural Gas Files A New Application

Nevada Natural Gas Pipe Line Company, of Las Vegas, Nevada, has filed a new application with the Federal Power Commission proposing the construction of a 114-mile pipe line to transport natural gas to markets in Nevada.

The application is similar to one that was denied by the FPC last November because the company failed to show that it had gas available for the service it proposed to render.

The project as now proposed would include the 114-mile, 10¾-in. line extending from a point on the east bank of the Colorado River, near Topock, Arizona, to the Las Vegas area, and a 4-in. branch line, about 4.5 miles long, extending from the main 10¾-in. line to the Boulder City, Nevada, area. The main line would have an initial capacity of 20,000,000 cu ft of natural gas a day.

Nevada Natural is proposing to supply gas to the Las Vegas Gas Company and to industrial and other users in Boulder City, Henderson, and Las Vegas and adjacent areas. These communities are now being supplied with liquefied petroleum gas and fuel oil, the application states.

Gas for the project would be purchased from El Paso Natural Gas Company, of El Paso, Texas, which now has an application pending with the FPC proposing that service, among other things.

Total estimated cost of Nevada Natural's project is $2,400,880.

FPC Hearing Has Been Postponed to March 3

The Federal Power Commission hearing has been postponed from January 28 to March 3 in the consolidated proceedings involving applications of Transcontinental Gas Pipe Line Corporation, Rockland Light and Power Company, and three subsidiaries of The Columbia Gas System, Inc. The postponement was requested by Transcontinental.

The proceedings include a request by Rockland for authority to build a 22-mile natural gas line in New York State, and applications by Transcontinental and the three Columbia subsidiaries—Atlantic Seaboard Corporation, United Fuel Gas Company, and The Manufacturers Light and Heat Company — involving gas supplies on their respective pipeline systems.

El Paso Natural Files Amended Applications

El Paso Natural Gas Company, of El Paso, Texas, has filed amended applications with the Federal Power Commission in connection with its plans to expand the capacity of its pipe line system to provide additional natural gas to customers in New Mexico, Arizona, and California, and to supply a new wholesale customer, which would serve markets in Nevada.

The facilities proposed in the two amended applications would provide an additional 500,000,000 cu ft of natural gas a day jointly to Pacific Gas and Electric Company, of San Francisco, California, and Southern California Gas Company and Southern Counties Gas Company of California, both of Los Angeles, California; up to 20,000,000 cu ft of gas daily to Nevada Natural Gas Pipe Line Company, of Las Vegas, Nevada; and remove present restrictions on annual deliveries of gas from the San Juan Basin.

The facilities covered by one of the amended applications (Docket No. G-1630) are estimated to cost $46,187,686, and would permit the delivery of (1) an additional 100,000,000 cu ft a day to Pacific Gas and/or Southern California and Southern Counties, (2) the gas to Nevada Natural, and (3) remove the annual restrictions on gas deliveries from the San Juan Basin Area.

The construction proposed in this application included 36.9 miles of main line loop, 32,560 in main line compressor horsepower, field transmission lines compressor stations, and gathering system, dehydration plants, a gasoline absorption plant, gas wells, and communication facilities.

In its original application in this docket, El Paso proposed a $16,970,000 ities that would permit the delivery of an additional 100,000,000 cu ft of gas a day to Pacific Gas.

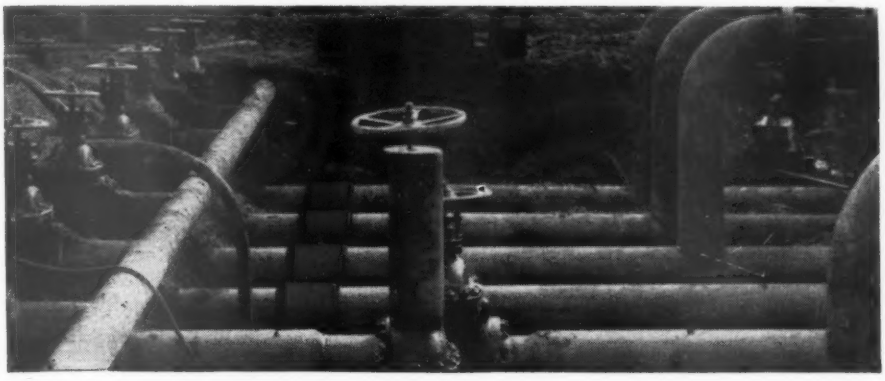
The other amended application (Docket No. G-1631) covers proposed facilities that would permit the delivery of an additional 200,000,000 cu ft a day jointly to Southern California, Southern Counties and Pacific Gas. This construction program, estimated to cost $62,695,000, includes 133.3 miles of main line loop, 14,800 additional compressor horsepower in existing stations, 105,000 hp in new and authorized main line booster stations, new field lines and field compressor stations and additions, purification and dehydration plants, field gathering systems, amine recovery plants, and other miscellaneous facilities.

El Paso's original application in this docket covered proposed facilities, estimated to cost $51,720,000, which would have been used to supply the same amount of gas to the three companies.

Service Pipe Line Adding Two Loops

Service Pipe Line Company is increasing the capacity of its crude oil trunk line system north of Drumright, Oklahoma, by 38,000 bbl daily with the construction of approximately 30 miles of 20-in. loops in Oklahoma and Kansas, C. M. Scott, general manager, announces.

The loops, laid parallel to the company's existing lines, will be in two sections, each approximately 15 miles long. One will extend north from Drumright, and the other south of Havana, Kansas. G. G. Griffis Construction Company, Tulsa, is the contractor.



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Interstate Announces Extensive Expansion Plans

Construction plans for 1952 involving extensive expansion and modernization projects along its system in three areas of Louisiana have been announced by Interstate Oil Pipe Line Company.

Principal programs include increasing the capacity of the company's south Louisiana trunk line system to 55,000 bbl a day; increasing the capacity of the southwest Louisiana system to 80,000 bbl a day, and extensive modernization of the Bunkie-Melville section of the Shreveport-Baton Rouge main line system.

Of the several projects included in these major programs, one has just been completed, one is under way, and contracts for others have not been let.

Just completed is a 4 and 6-in. gathering system in Duck Lake field in St. Martin Parish, and a connecting 8-in. line, 9 miles in length, to Interstate's trunk line system near Bayou Sale, on the southwest Louisiana system. Begun last November, the Duck Lake system went into operation February 1.

Currently under way as the first step in the main line modernization program is the complete replacement of Bunkie Station, one of the first to be constructed on the former Standard Oil Company of Louisiana pipe line system, which was started in 1909. The original station is being replaced by a completely new station equipped with three centrifugal pumps each to be driven by a 1000-hp dual fuel engine, and incorporating remote controls for efficient operations and major automatic safety devices for protection of personnel and equipment.

Construction of the new Bunkie Station is expected to be completed in midsummer of this year.

Before Bunkie Station is completed, contracts will be let for the construction of 32 miles of 20-in. line between Bunkie and Melville stations, which will replace the multiple 8-in. and double 12-in. lines now in use. A related project is a new 12-in. submerged river crossing under the Atchafalaya River near Melville, Louisiana. In line with previous experience on the Atchafalaya near this point. Interstate's specifications for the new crossing will call for 12-in. river pipe with ½-in. wall thickness, protected by ½-in. coating and wrapping and a 1-in. coating of concrete. Both the new 20-in. trunk line and the crossing are scheduled for completion during the summer.

In the south Louisiana system, the 1952 program includes replacement of the existing 8 and 10-in. trunk line between Raceland and Anchorage Terminal, near Baton Rouge, with 68 miles of 16-in. line, and the laying of 18 miles of 12-in. line south of Raceland to replace the present 6 and 8-in. trunk line between Raceland and LaRose stations. Present plans call for construction to begin in early summer, with completion scheduled by fall increasing the capacity to 55,000 bbl a day.

Expansion of the South Louisiana system will provide additional pipe line capacity for the increasing production of newly discovered fields and other producing areas such as Plaquemine, Lake Chicot, Valentine, Raceland, Delta Farms, Golden Meadow, Napoleonville, Bully Camp, Bayou Choctaw, and Bayou Couba fields.

Capacity of the larger southwest Louisiana system will be increased to 80,000 bbl a day by replacement of the present 8 and 10-in. trunk line from Sunset to Anchorage Terminal with 55 miles of 16-in. line; construction of 23 miles of 12-in. line south of New Iberia, Louisiana, to replace the existing 6-in. line between New Iberia and Bayou Sale, and construction of a new pump station in the vicinity of New Iberia.

The new station will be equipped with three 400-hp pumping units, giving it initial capacity of 50,000 bbl a day.

The southwest Louisiana projects, for which contracts have not yet been let, are slated to begin in mid-summer, with completion scheduled this fall.

Completion of these projects will substantially increase pipe line capacity out of important producing areas extending from Baton Rouge to North Crowley on the west, and to Bayou Sale on the south. Among the major fields affected by this expansion are Weeks Island and Avery Island, which Interstate recently entered with trunk line and gathering facilities, Section 28 Dome, Port Barre, Krotz Springs, North Crowley, Anse La Butte, Bayou Sale, and Jeanerette.

West Texas Gas Company Withdraws Application

The Federal Power Commission has permitted West Texas Gas Company, of Lubbock, Texas, to withdraw an application in which it was proposing to construct pipe line facilities to increase its natural gas system capacity by about 24,000,000 cu ft a day to a new total daily capacity of approximately 135,000,000 cu ft.

The proposed project included construction of about 32.5 miles of pipe line and compressor station additions totaling 2010 hp on the company's system in Potter and Randall counties, Texas. Estimated cost of the construction was $1,636,145.

At a hearing which convened on January 16, West Texas said that its application no longer conformed to the factual situation involved or to the company's plans, and that it intended to file a new application. The hearing, which also involved two other applications, was then recessed subject to further order of the commission. The other applications involved in the consolidated proceedings are those of Southern Union Gas Company, of Dallas, Texas, and El Paso Natural Gas Company, of El Paso, Texas. Southern Union is proposing to increase natural gas deliveries in the Clovis, New Mexico, area, while El Paso is seeking authority to reduce deliveries of gas to Southern Union's supplier, which is West Texas Gas Company.

United Gas Files Two Applications With the FPC

United Gas Pipe Line Company, of Shreveport, Louisiana, has applied to the Federal Power Commission for authority to construct approximately 36 miles of pipe line to connect its natural gas transmission system with a new source of supply in an underwater field near Corpus Christi, Texas.

The proposed line, estimated to cost $2,735,000, would extend from a proposed purchase meter station for the Mustang Island (Red Fish Bay) field, offshore from Ingleside, Texas, to a connection with United's system near Refugio, Texas. Capacity of the line would be approximately 130,000,000 cu ft of gas a day. The gas would be purchased from Sunray Oil Corporation.

United Gas also has asked the Federal Power Commission to authorize the construction of compressor facilities on its Napoleonville (Louisiana)-Kosciusko (Mississippi) line, now under construction, to increase its capacity by 100,000,000 cu ft of natural gas a day to serve Southern Natural Gas Company, of Birmingham, Alabama.

United is proposing to construct two new compressor stations, having a total capacity of 13,280 hp, one at Napoleonville and the other at Jackson, Mississippi. United also asked FPC to authorize the addition of a total of 8000 hp at two authorized stations, located near Montpelier, Louisiana, and in Walthall County, Mississippi, respectively.

The additional 100,000,000 cu ft of gas would be delivered to Southern Natural through a proposed meter station to be constructed near Kosciusko. The estimated overall capital cost of the facilities is approximately $5,764,000, the application states.

PG&E Asks Authority For 50-Mile Gas Line

Pacific Gas and Electric Company, of San Francisco, California, has applied to the Federal Power Commission for authority to construct approximately 50 miles of pipe line, which would be used to increase natural gas deliveries to the Fresno-Merced service area.

The company said that the new facilities, estimated to cost a total of $1,979,000, would reinforce its existing transmission system so that future peak noncurtailable gas demands of customers in this service area can be supplied through the year 1955. The only new communities that might possibly be served through the facilities, the application states, are Planada, Le Grand, Highway City, and Biola, California.

The proposed construction program includes 20 miles of 16-in. in Fresno County, extending from Burrel to a point near Easton; 15 miles of 20-in., also in Fresno County, from Helm to the company's Topock-Milpitas line and paralleling a portion of an existing line and 15.5 miles of 12¾-in. pipe, which would parallel the existing Madera-Livingston line in Madera County.

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Through the years, these qualities have proved themselves. Many oil and gas pipe lines, protected by Bitumastic Enamels in the '20's, are still giving good service today.

Specify Bitumastic Enamels and give your pipe lines the same effective protection against corrosion. Your Koppers representative will give you complete details and estimates.

Bitumastic Enamels soon available from Koppers new California Plant!

As soon as present construction work is completed, Koppers will be able to supply Bitumastic Enamels from a new plant at Fontana, California. The plant is being built to give you better service in the West.

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With the PIPE LINE CONTRACTORS

Houston Contracting Corporation, 2707 Ferndale Place, Houston, Texas, has the following construction work under contract:

Approximately 220 miles of 22-in. crude oil pipe line for The Texas Pipe Line Company from the vicinity of Houma, Louisiana, to Port Arthur, Texas. This work will be handled by three spreads, all of which will start preliminary work about March 1 and laying pipe about March 15.

One spread will lay 67 miles of 22-in. from vicinity of Holmwood, Louisiana, west to Port Arthur, Texas. E. C. Norris, superintendent; R. E. Thornton, assistant superintendent; R. J. Axsom, field office manager; headquarters, Lake Charles, Louisiana.

A second spread will have 67 miles of 22-in. from vicinity of Holmwood, east to Gueydan, Louisiana, and from Morgan City, Louisiana, east to Houma. W. H. Hayes, superintendent; M. L. Thompson, assistant superintendent; J. C. Strickler, field office manager; headquarters, Jennings, Louisiana.

The third spread will lay 86 miles of 22-in. from vicinity of Gueydan, east to Morgan City. F. A. Silar, superintendent; C. V. Oliver, assistant superintendent; L. F. Redfearn, field office manager; headquarters, Abbeville, Louisiana.

Approximately 95 miles, consisting of 30 miles of 12-in. and 65 miles of 6, 8, and 10-in. crude oil pipe lines for The Texas Pipe Line Company from Houma, Louisiana, south to and through the Terrebonne Bay vicinity. H. L. Leake, superintendent; S. B. Harrison, assistant superintendent; H. C. MacWhinnie, field office manager; headquarters, Houma, Louisiana. Preliminary operations to start about March 1 and laying pipe about March 10.

Five major river crossings for The Texas Pipe Line Company from the vicinity of Morgan City, Louisiana, west to Orange, Texas. J. A. Cantrell, superintendent; J. B. Stoddard, field office manager; headquarters, Morgan City, Louisiana. Preliminary work began February 25.

River Construction Corporation, 6100 Camp Bowie Boulevard, Fort Worth, Texas, has the following work in progress:

Spread No. 1. Laying 30-in. pipe from the Pearl River, 26 miles south of Jackson, Mississippi. Lacks approximately 7 miles from the Pearl River, north of Jackson, Mississippi. Red Tatom, superintendent. Office, Jackson, Mississippi.

Spread No. 2. Laying 30-in. pipe from Kosciusko, south. Lacks approximately 20 miles reaching the Pearl River, north of Jackson, Mississippi. Jimmy Reid, superintendent. Office, Kosciusko, Mississippi.

Spread No. 3. To lay 26-in. pipe from Sterlington Station to Perryville. Just started. Merle Tatom, superintendent. Office, Monroe, Louisiana.

Spread No. 4. Installing Pearl River crossing, north of Jackson, Mississippi. Charlie Simmons, spreadman.

The above spreads are on the approximate 1000 miles of additions to the existing facilities of the United Gas Pipe Line system in Texas, Louisiana, and Mississippi.

Spread No. 5. Installing Trinity River crossing on the 20-in. line from Orange to Port Neches. Banty Traweek, superintendent.

Spread No. 6. Laying 20-in. pipe from Fannett toward Houston. Borger Red McMenamy, spreadman.

Spreads No. 5 and 6 are under the general supervision of Barney Hall with offices at Liberty, Texas, and are on the United Gas Pipe Line 97 mile, 20, 24, and 26-in. line from Orange to Houston.

Jake Minyard is the general superintendent over all the operations for River Construction Corporation with headquarters at Fort Worth. P. O. Box 9127, phone Sunset 6518, office and Sunset 2104, warehouse.

Oklahoma Contracting Company, 6512 Hines Boulevard, Dallas, Texas, is laying the following pipe for United Gas Pipe Line Company:

Needville, Texas, to a point 47 miles northeast of Goodrich—154 miles of 30-in. This spread is in charge of Louis Visentine with Dick Mueller in charge of the field office, which is at Rosenberg.

Pierce Junction to Refugio, Texas—86 miles of 30-in. Fifteen miles remained to be laid February 20. Headquarters are at Victoria with Raymond Law superintendent and Henry Turner office manager.

Refugio to Agua Dulce—53 miles of 24-in. This spread has been shut down due to lack of right-of-way but is now at work with 38 miles yet to lay. The office is at Sinton. Ed Flannagan is superintendent and Hank Scherer office manager.

Dunn Brothers, 801 Mercantile Securities Building, Dallas, Texas, (stringing contractors) are stringing 22 miles of 26-in. pipe on the Algonquin Gas Transmission Corporation job, which extends from Lambertsville, New Jersey, north. The general contractor is Construction Service Company of Bound Brook, New Jersey.

For Southern Union Gas Company, 30 miles of 8-in. pipe is being strung from Gallup, New Mexico, to a point near Bloomfield.

An undetermined amount of stringing is being done for Tennessee Gas Transmission Company in southeastern Tennessee and Mississippi. Various work also is being done in New Mexico for El Paso Natural Gas Company.

Parkhill Truck Company, P. O. Box 1856, Tulsa, Oklahoma, announces the following work in progress:

94 miles of 20, 24, and 26-in. for United Gas Pipe Line Company; Contractor, River Construction Corporation, from Port Neches to Houston, Texas. R. M. Hiser, foreman.

150 miles of 30-in. for Texas Eastern Transmission Corporation from Wheelersburg, Ohio, to Powhatan Point, Ohio, and 66 miles from Uniontown, Pennsylvania, to Moundsville, West Virginia. Contractor, Anderson Brothers Corporation. Foremen, Ray Herron and Jimmie Stubblefield.

125 miles of 30-in. for United Gas Pipe Line Company; contractor, River Construction Corporation, from Louisiana-Mississippi state line to North Crossing of the Pearl River near Jackson, Mississippi. Foreman, Charles Sampson.

36 miles of 30-in. for United Gas Pipe Line Company; contractor, River Construction Corporation, from North Crossing of Pearl River to Kosciusko, Mississippi. Foreman, O. C. York.

280 miles unloading Shell Pipe Line Corporation's 14-in. pipe from Wood River, Illinois, to East Chicago, Indiana.

28.6 miles of 20-in. pipe for Service Pipe Line Company's loops in northern Oklahoma and southern Kansas. Contractor, G. G. Griffis Construction Company.

41 miles of 10-in. for Phillips Pipe Line Company, Harrisonville and Louisburg loops in Missouri. Contractor, Smith-Donaho Contracting Company. Foreman, John Greer.

40 miles of 10-in. for Service Pipe Line Company, from near Aspermont, Texas, to Snyder Texas. Foreman, H. C. Peterson. Contractor, Vaughn and Taylor Construction Company of Wichita Falls, Texas.

Rumsey Brothers Pipe Line Construction Company, 4039 North Boulevard, Wichita, Kansas, is now receiving pipe and expects to get under way in March on its section of the Platte Pipe Line Company system. This contractor will lay 100 miles of 20-in. from the Nebraska-Kansas state line near Lanham, Kansas, to the Missouri River near Doniphan, Missouri.

G. G. Griffis Construction Company, P. O. Box 418, Tulsa, Oklahoma, is constructing 29 miles of 20-in. pipe line in two loops for Service Pipe Line Company. The loops are between Drumright and Terlton, Oklahoma, and Blake station and Havana, Kansas. A crossing also is being made of the Cimarron River. The field office is at Drumright. "Rip" Grisham is superintendent and Frank Durfee office manager. The river crossing is in charge of John Griffis.

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To obtain more information on products advertised see page E-41

Ray L. Smith and Son, Inc., Hazlett Building, El Dorado, Kansas, are completing the take-up, recondition, and relay of 175 miles of 6-in. products pipe line for Socony-Vacuum Oil Company, Inc., White Eagle Division, between Augusta, Kansas, and Kansas City. Three spreads are located as follows:

Emporia, Kansas—Dewey Whitworth superintendent and Don Marley office manager.

Lawrence, Kansas — Clark Leggitt superintendent and Jimmie Reid office manager.

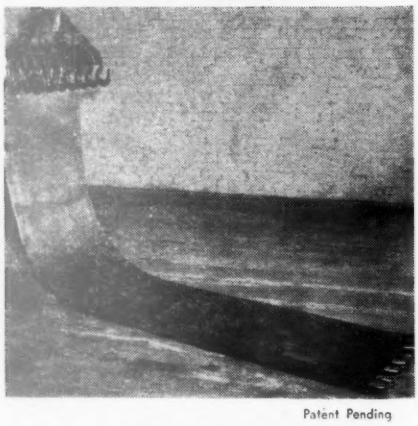
Kansas City, Kansas—L. G. Veach superintendent and John Salisbury office manager.

Bishop and Lock Construction Company, 1018 Magnolia Building, Dallas, Texas, will finally get under way on the Platte Pipe Line Company job about March 15. The contract calls for the laying of 142 miles of pipe between Marysville, Kansas, and Holdredge, Nebraska, but work has been held up for approximately a year because pipe was not available. The field office will be at Holdredge. Howard Laquey will be in charge.

Laquey at the present time is supervising the laying of 82 miles of pipe line in the Pegasus field of West Texas for Magnolia Pipe Line Company, which job is about half completed. Pipe sizes are from 3½ through 24 in. The field office is at Odessa. Bob Stiles is office manager.

NEW WIRE ROPE

BELT SLING



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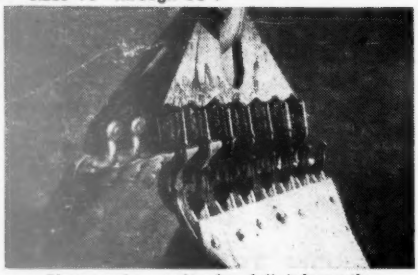
The only Belt Sling specially designed for Pipe Liners. Surpasses all other Belts in strength and dependability. Easily connected by one man by elimination of heavy bolt. Sizes 10" through 36".



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Vic Knudsen Rigging Co.

134 Sacramento St., San Francisco 11, Calif.

Anderson Brothers Corporation, 707 North Drennan Street, Houston, Texas, has two spreads at work for West Texas Gulf Pipe Line Company. One spread, working out of Hillsboro, Texas, is laying 50 miles of 26-in. between Granbury and Hillsboro. M. E. "Panama" Shiflet is general superintendent, Gene Coulter spreadman, and Dick Bond office manager.

The second spread is laying 44 miles of 26-in. from Hillsboro to Wortham, and is making its headquarters at Hubbard. W. H. "Cooney" Shiflet is spreadman and Fred Pervis office manager.

If weather permits, two spreads will go to work about March 15 on 217 miles of 30-in. for Texas Eastern Transmission Corporation between Portsmouth, Ohio, and Connellsville, Pennsylvania. One spread has its headquarters at Uniontown, Pennsylvania, the other at Caldwell, Ohio. R. L. McMillon is general superintendent for both spreads.

O. R. Burden Construction Corporation, 6702 East 21st Street, Tulsa, Oklahoma, now has his field headquarters at Carrollton, Missouri, on the Platte Pipe Line Company job. The section of line being laid between Salisbury and St. Joseph is of 20-in. pipe. A. T. Perry is superintendent, K. N. Adkins assistant superintendent, and Howard Smith, Jr., office manager.

Overall, Burden is laying 280 miles of the Platte system, from St. Joseph to Wood River, Illinois.

Three spreads, including a river crossing spread, are engaged in the laying of 154 miles of 24-in. for Sinclair Pipe Line Company between Cushing, Oklahoma, and Humboldt, Kansas. This is a part of the 22 and 24-in. line that will extend 675 miles from Cushing to East Chicago, Indiana. The spread under A. B. Haynes has its field offices at Independence, Kansas. Bill Clyma is office manager. A second spread, under Floyd Lewis, is making its headquarters at Yale, Oklahoma. Ben Mapes is in charge of this office. At Yale, also, the river crossing spread under Virgil Lambert is making its field headquarters. The Cimarron River crossing has been completed and work is now in progress on the Arkansas River.

Midwestern Constructors, Inc., 105 North Boulder, Tulsa 3, Oklahoma, has completed approximately 85 per cent of its work at Tuscola, Illinois, for Panhandle Eastern Pipe Line Company, which consists of installing an additional compressor unit. H. H. Voss has charge of the office there. Two units are being installed for the same company at Edgerton, Indiana, and this work is about 60 per cent completed. K. L. Kreamalmyer is superintendent of the work.

Somerville Construction Company, Ada, Michigan, began work January 30 on 34 miles of 8-in. pipe line for Phillips Pipe Line Company between Kankakee, Illinois, and Dyer, Indiana. O. P. Hiner is spreadman.

Mid-States Construction Company, P. O. Box 417, Mount Vernon, Illinois, has contracted another 8 miles of 10-in. with Phillips Pipe Line Company. This mileage will be from the Merrimac River to the Mississippi River near St. Louis, Missouri. The contract also calls for the reconditioning of 6 miles and the relocation of 2 miles 8-in.

The contractor has been at work for some time on 42.3 miles of 10-in. for the same company consisting of two loops, one from Green Ridge to Syracuse Station and the other from Delmold, Missouri, to Villa Ridge, Missouri. The field office is at Union. T. H. Edmonds is superintendent and Ed Rensch office manager.

Altgelt Construction Company, Inc., P. O. Box 1402, Corpus Christi, Texas, began laying late in February a 25-mile gathering system for United Gas Pipe Line Company in the Agua Dulce area, Texas. Pipe sizes are 4 in. through 16 in. The field office is at Robstown.

In addition, 19 miles of 4, 6, and 8-in. pipe are being laid for Magnolia Petroleum Company near George West, Texas.

Lee Phillips is superintendent over both jobs.

Bills and Troth, 428 Wright Building, Tulsa, Oklahoma, is laying pipe between Neodesha, Kansas, and Belton, Missouri, on the Standard Oil Company (Indiana) 8-in. products line. The contractor has his field office at Iola, Kansas, and is working north until he meets P. and S. Constructors, Inc., working south. Carl Bills is superintendent, R. E. Wallace spreadman, and Vivian Grizzell office manager.

P. and S. Constructors, Inc., Cape Girardeau, Missouri, are working from Belton, Missouri, south to meet the Bills and Troth spread coming north from Neodesha, Kansas, on the Standard Oil Company (Indiana) 8-in. products pipe line. The field office is at Louisburg, Kansas. Trece Boyd is superintendent and V. E. Connor office manager.

Vaughn and Taylor Construction Company, Box 1351, Wichita Falls, Texas, expects to complete about March 15, 38.5 miles of 10-in. pipe line for Service Pipe Line Company, extending from the Cogdell field in southern Kent County, Texas, to Aspermont in Stonewall County. D. D. Vaughn is superintendent. The field office is at Rotan.

Associated Pipe Line Contractors, Inc., 3272 Westheimer Road, Houston, Texas, has contracted to lay 120 miles of 26-in. on the West Texas Gulf Pipe Line Company system. The section will be from Glen Rose to a point west of Abilene, Texas. The field office is at Stephenville and work already has begun under the supervision of L. H. Gray as general superintendent and Keller Davis assistant superintendent. Jack Bradley is in charge of the field office. A second spread has its office at Eastland with Willie Briley spreadman.

C. E. Wilson Construction Company, 1401 Fairfax Trafficway, Kansas City 15, Kansas, is constructing a diesel pumping station for Mid-Valley Pipeline Company near Simpsonville, Kentucky, on its 22-in. crude oil system. Thad W. Wilson is in charge.

For the Iowa-Illinois Gas and Electric Company an undetermined amount of ¾-in. through 6-in. pipe is being laid in Davenport, Iowa, and Moline, Illinois. Joe Drouillard is superintendent.

L. E. Farley, Inc., 2609 Sunset Boulevard, Houston, Texas, began work in February on 40 miles of 16-in. for United Gas Pipe Line Company from Bay Minette, Alabama, to Pensacola, Florida, which will parallel the company's existing 12-in. line. The field office is at Bay Minette. L. D. Berton is superintendent and Wallace Campbell office manager.

For Interstate Natural Gas Company, 20 miles of 4, 6, and 8-in. pipe line are being laid between Fayette and Natchez, Mississippi. The field office is at Fayette.

Trojan Construction Company, 1416½ North Robinson, Oklahoma City, Oklahoma, is working on a 21.5-mile section of 24-in. between Depew and Kellyville, Oklahoma, for the Oklahoma Natural Gas Company. This is a part of 93 miles of 12, 16, and 24-in. that will be laid for the company. The field office is at Bristow. Charles T. "Swede" Tillotson is superintendent and Don Wilson office manager.

Modern Welding Company, Box 573, Owensboro, Kentucky, is constructing a complete city gas system for Gallatin, Tennessee, consisting of 40 miles of ¾-in. through 10-in. pipe. The job has been shut down but will reopen March 15. The work is approximately half completed.

The company has contracted with Texas Gas Transmission Corporation to make a 2 mile 10-in. replacement and a 2 mile 6-in. replacement in its system. The former will be installed in June, the latter in April.

Williams Brothers Corporation, National Bank of Tulsa Building, Tulsa, Oklahoma, has several jobs under way and several others to start at a later date. Among those already started are 10 miles of 12-in. for Central Kentucky Natural Gas Company, extending from Lexington toward Winchester. The field office is at Lexington. R. H. Abmeyer is superintendent. For Piedmont Natural Gas Company, 19 miles of 8, 10, and 12-in. pipe is being laid at Charlotte, North Carolina. Clayton Parry is spreadman. A city distribution system is being installed at Salisbury, North Carolina, for the Piedmont Natural Gas Company. This will consist of about 7 miles of 4-in. Another city distribution system is being installed at Chamblee, Georgia, this one for the Atlanta Gas Light Company. The amount of pipe to be laid is undetermined. E. U. Mahaffey is the superintendent. For the Public Service Company of North Carolina, 20 miles of 4-in. are being laid at Mooresville, Kanapolis, and Concord.

The laying of 18 miles of 6 and 8-in. for Piedmont Natural Gas Company at Greenville, South Carolina, is expected to begin in March with Brownie Young in charge. At some later date 14 miles of 3, 4 and 6-in. pipe will be laid for the Public Service Company of North Carolina at Adenville and Belmont. The field office for the work in North Carolina is at Charlotte. H. W. Franks is division superintendent and Thelma Davis is pushing the spreads.

For the Minneapolis Gas Company, 30 miles of 26-in. will be laid inside the city. The date for the start of this work has not been announced.

Mahoney Contracting Company, 2300 North Grand Avenue, Lansing, Michigan, is working on approximately 95 miles of 8-in. through 24-in. pipe line for the Michigan Gas Storage Company, between Laingsburg and Mt. Clemens, Michigan. The field office is at Rochester. Barney Finnerty is superintendent and Al McConnell office manager.

George Tucker Pipe Line Construction Company, P. O. Box 1987, Odessa, Texas, is completing 51 miles of 8-in. for the Plains Pipe Line Company from the Spraberry field to a pump station near Goldsmith, Texas. D. H. Damron is spread foreman and C. P. Brownell office manager.

PEWTHERS' "EARTHRIPPER"...
A MAN'S MACHINE FOR A MAN'S JOB!

OPENS THE EARTH LIKE A ZIPPER!

ECONOMICAL Construction engineers using the Pewthers' EARTHRIPPER find that it costs only 4¢ a foot to operate. This low cost covers initial investment, depreciation, operation, maintenance, and labor over a three-year period! With an EARTHRIPPER, one man handles your ditching problems, from driving the machine to the ditch site to lowering the boom and opening the earth at a maximum rate of *twenty feet a minute!* 90% of replacement parts can be bought *locally.*

MOBILE On the highway its speed is the speed of a truck. Raised boom clears telephone wires and tree branches, making transit easy. The EARTHRIPPER digs vertical ditches in any kind of terrain. On slopes the frame levels.

EFFICIENT The EARTHRIPPER is the first ditcher to be built into a truck. Bucket design saves time because there is no lost time in cleaning. Bottom of each bucket is formed by bucket preceding it. Buckets separate as they go over the top sprocket, throwing dirt onto the conveyor belt; the conveyor belt deposits dirt on either side of the ditch and can be reversed at a moment's notice.

IT'S BUILT "HELL-FOR-STOUT"

Pewthers' EARTHRIPPER is the only ditcher built into a standard truck. This means *one man* can handle your ditching job, from driving the machine to the ditch site to opening the earth to a maximum depth of five feet. The EARTHRIPPER is particularly suited for gas lines, extensions and house-to-street service lines. Utility ditching requiring ditches 10", 14", or 18" wide are duck soup to this new, *different* Pewthers' ditcher.

I want the new folder on the Pewthers' "EARTHRIPPER."

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I saw this ad in the above magazine.

PEWTHERS DITCHER COMPANY

2323 CLAIBORNE AVE. • SHREVEPORT, LOUISIANA

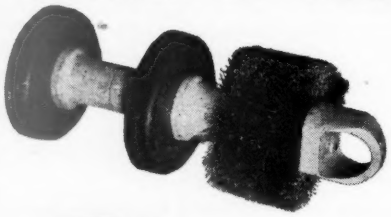
▸ **R. H. Fulton and Company,** P. O. Box 1526, Lubbock, Texas, now has its field office at Scottsbluff, Nebraska, on the Platte Pipe Line Company job. A. A. Carrigan is superintendent and D. G. Wagner is in charge of the office. The contractor will lay a total of 433 miles of 20-in. pipe between Casper, Wyoming, and Brule, Nebraska.

▸ **Reese Brothers Construction Company,** Hugoton, Kansas, has passed the half-way mark on the 181-mile gathering system being laid for Northern Natural Gas Company in Texas County, Oklahoma, and Kearney, Finney, Haskell, Seward, and Morton counties, Kansas. Pipe sizes are 4, 6, and 8-in. Paul Reese and Gale Reese are superintendents, Edd Reese spreadman, Chet Beighle office manager, R. D. Schellenbarger chief inspector, and I. P. Toten welding inspector.

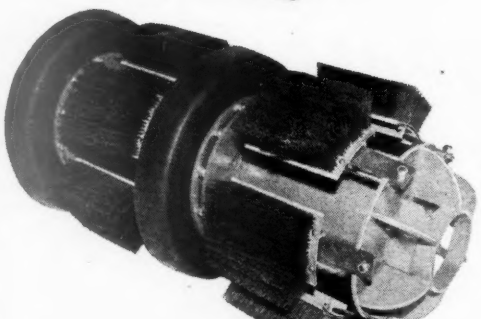
▸ **Gulf Southern Contractors,** 516½ Louisiana Avenue, Shreveport, Louisiana, have the overall contract to lay approximately 1000 miles of pipe line for United Gas Pipe Line Company in Louisiana, Texas, and Mississippi. Gulf Southern is a contracting group consisting of River Construction Corporation, Fort Worth; Oklahoma Contracting Company, Dallas; J. Ray McDermott and Company, New Orleans, and Morrison-Knudsen Company, Boise, Idaho.

THE PIG WITH THE POKE — CLEANS PIPE LINES

MORE BARRELS PER DOLLAR . . .
THROUGH OIL PIPE LINES
CLEANED BY WILLIAMSON PIGS



Type JR Pig 2" to 5" sizes. Economical and Rugged.

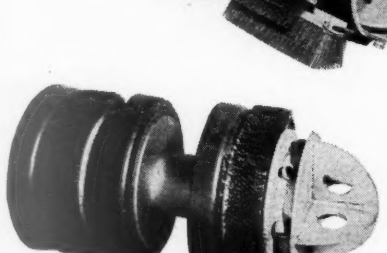


Type GP-4 Pig 16" to 30" sizes.

Similar design for 10" to 14" sizes.

Brushes expanded by arched springs.

Brush and cup service life up to 1,000 miles.



Type RC-50 Pig 8" to 14" sizes.

6" size, similar, type SC-50.

Jet-rotation feature distributes wear of brushes and cups.

REPRESENTATIVES

H. E. Davis, Los Angeles 15, Calif. — James S. Kone Co., Amarillo, Texas — Keyes Tank Co., Provo, Utah — Keyes Tank & Supply Co., Casper, Wyoming

Canadian Equipment Sales & Service Co., Ltd., Edmonton, Calgary, Toronto, Canada

T. D. Williamson, Inc.
TULSA 9, OKLAHOMA

▸ **Comstock Midwestern, Ltd.,** 206 Laird Drive, Leaside, Ontario, will lay 472 miles of Trans Mountain Oil Pipe Line Company's 693-mile, 24-in. system between Edmonton, Alberta, and Vancouver, British Columbia. This contractor will construct the eastern and western portions of the line. Right-of-way work will begin as soon as weather permits and pipe laying about June 1.

The contractor is laying 235 miles of line for the Sarnia Products Pipeline Company, subsidiary of Imperial Oil, Ltd., from Sarnia to Toronto. The pipe is mostly 10 and 12 in. The field office is at Strathroy, Ontario. Denver Franklin is superintendent, J. A. Kippan assistant superintendent, and E. C. McFadden office manager.

▸ **Lewie Montgomery Trucking Company,** Box 432, Odessa, Texas, is stringing 84 miles of 2-in. through 24-in. pipe for Bishop and Lock. The latter is general contractor for a gathering system in the Pegasus field, Upton County, Texas, for Magnolia Pipe Line.

▸ **Mannix, Ltd.,** Calgary, Alberta, will construct approximately 221 miles of the Trans Mountain Oil Pipe Line Company's system, which overall will extend 693 miles from Edmonton, Alberta, to Vancouver, British Columbia. The section will be in the center of the line. Right-of-way clearing will begin as soon as weather permits. Pipe laying is scheduled to begin about June 1. The line will be constructed of 24-in. pipe.

▸ **Smith Contracting Corporation,** 205 Northwest Seventh Street, Fort Worth, Texas, has opened a field office at Teague, Texas, and begun right-of-way and casing work on 175 miles of 16-in. for The Texas Pipe Line Company between Corsicana and East Houston, Texas. Frank Craig is spreadman, M. E. Williams office manager, and Art Renton engineer and purchasing agent.

▸ **Smith-Donaho Contracting Company,** 205 Northwest Seventh Street, Fort Worth, Texas, is laying 41 miles of 10-in. between Paola, Kansas, and Warrensburg, Missouri, for Phillips Pipe Line Company. The office is at Warrensburg. Herb Smith is superintendent, H. E. Doyle spreadman, and Ernest Bell office manager.

▸ **Glaser Construction Company,** Box 21, Lafayette, Louisiana, is laying 58 miles of 8-in. pipe line in two sections for Gulf Refining Company. Work at present is on 33 miles between the Trinity River near Cove, Texas, and Beaumont. The field office is at Winnie, with Roy Earnheart spreadman and H. A. Matt office manager. This job is expected to be completed by the middle of March, when work will begin on the 25 mile section from Cove to Deer Park.

▸ **Knapp Brothers Construction Company,** Box 225, Oxford, Kansas, was scheduled to start March 1 on the reclaiming of 20 miles of 6-in. pipe for Service Pipe Line between Neodesha and New Albany Junction, Kansas.

Two employees look over their vacation resort purchased for them by Helmerich and Payne, overlooking Fort Gibson Lake, Oklahoma.

Employees Vacation Spot

Recreational site for exclusive use of their employees brought by Helmerich and Payne

Less than an hour's drive from Tulsa, one of the Oil Capital's leading firms is introducing an innovation in employee relations.

On a 1000 acre reservation in a sheltered cove on Ft. Gibson Lake near Wagoner, an independent oil company, Helmerich and Payne, Inc., has established a permanent modern recreation area open to its 600 employees in six states. It is complete with roomy individual cabins, and a large lodge where employees can spend days or weeks, or where they even can make their future home.

In conceiving of this project as a major step in its employee-relations program, the firm introduced a novel arrangement whereby any employee can purchase one of the sturdy cabin homes at a very nominal price, including a small down payment. Each remains the personal property of the employee unless he leaves the company, in which event he is refunded the entire amount he has invested toward purchase of the property.

Of the 13 cabins already constructed, eight are now owned and occupied by employees, with five available for vacationing Helmerich and Payne employees at a small rental fee, on request to the Tulsa general office.

It is named the Cherokee Club, with every company employee as a member.

Each cabin, of concrete block and gravel roof construction, designed by Ted Reeds and built under supervision of Helmerich and Payne employees, conforms in exterior configuration to company-approved plans, but a variety of interior designs are available. All cabins are completely furnished, with wood-burning fireplaces, electrical heating, sleeping accommodations for six (with foam rubber beds), electric stoves and refrigerators, 40-gallon hot water heaters, and telephone service, while television reception is rated "good" in the area.

With space available for a large number of additional cabins, preliminary construction is well advanced on six additional units scheduled for completion this spring. All locations are to be chosen by lot. Then, too, there will be boat houses, a roped off swimming area, two swimming piers, and a sand beach within 75 ft of the present cabin area. Shuffleboard courts and rowboats are to be provided.

The lodge has a completely-equipped kitchen and large private dining room available for special groups.

All-weather roads serve the club property and access is over a picturesque entrance drive that winds past and over three company-built lakes, to be stocked for fishing. A full-time superintendent, A. C. Duncan, is in charge of the property.

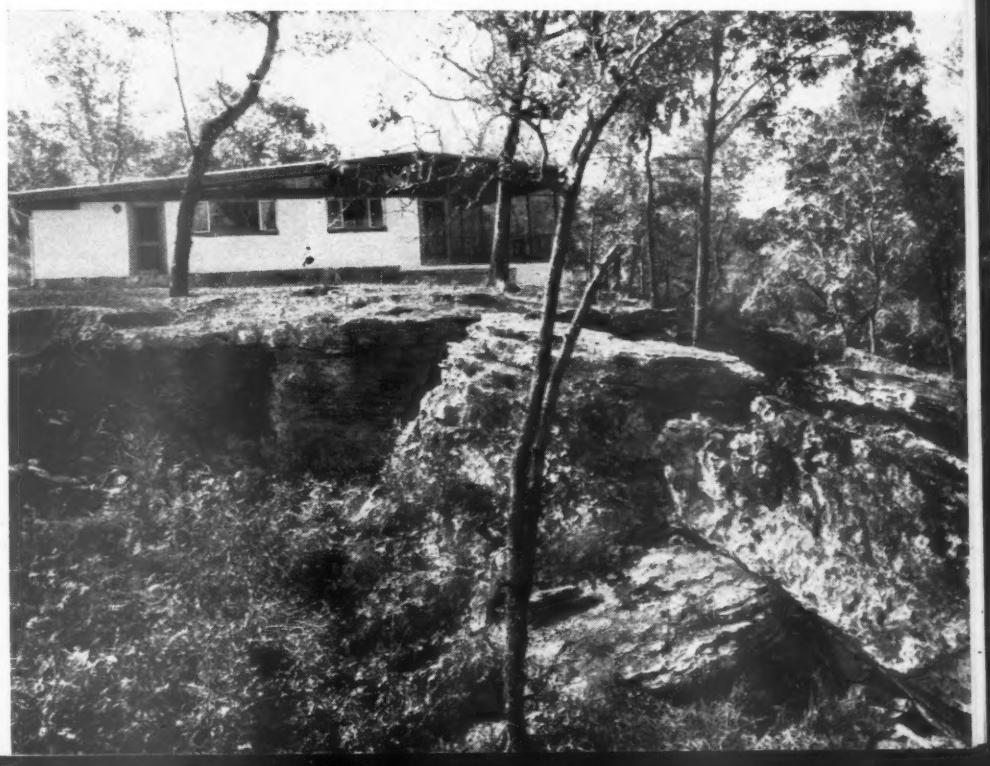
There is even a right-at-hand supply of fresh country eggs and chickens, supplied by Mr. Thomas, an Oklahoma A. & M. graduate, and his wife, who live in the new tenant farmhouse built by Helmerich and Payne on the club grounds. Soon they will have 300 company-supplied registered cattle to care for.

The proximity of the location (30 miles closer than Grand Lake) to Tulsa is considered a definite advantage to home office employees, and for those situated farther afield (who enjoy a priority on rental cabins) the club offers more economical accommodations than those available at comparable, equidistant recreation spots.

To give employees a preview of their club, Helmerich and Payne has supplied each of its district offices with copies of a leather-bound, fully-illustrated presentation book picturing and describing all aspects of the area.

Opening of the club marks the latest step in Helmerich and Payne's employee relations program. Ten years ago the company introduced an employee pension program, one of the first of the smaller oil companies to do so. With the company supplying all amounts going to the pension fund, the plan has won wide recognition and commendation. * * *

Typical of the rugged beauty of the surroundings of the Cherokee Club, is this side view of the main lodge.



NEWS

Major Oil Companies Agree To Supply East Coast Fuel

Twelve oil companies will make available 3,000,000 bbl of heating oil in the next 2 months to cover a possible shortage of fuel oil on the East Coast, at a cost of between $7 to $8,000,000 to themselves. The companies agreed to carry out this request by Petroleum Administration for Defense, after an earlier proposal by the Office of Price Stabilization for a subsidy was rejected. The gas will be delivered to East Coast resellers designated by the PAD at present ceiling prices.

The threatened shortage of fuel oil on the East Coast will be prevented by the 12 companies, on the promise of Mobilization Director Charles E. Wilson and Stabilization Director Roger Putnam that the OPS "will carefully review the price ceilings of petroleum products on the East and Gulf Coasts and will institute any agreed-upon changes no later than June 1, 1952."

The OPS will probably increase ceilings to relieve the 12 suppliers of loss in the future.

Plan for a government subsidy was killed by Wilson and Production Administrator Manly Fleischmann, after it had been suggested to the companies by Deputy Petroleum Administrator Bruce K. Brown, on the ground of fears that demands for subsidies would spread to other industries.

Companies agreeing to provide any additional heating oil needed include: Gulf Oil, Esso Standard, Texaco, Socony-Vacuum Oil, Shell Oil, Sinclair Refining, Sun Oil, Atlantic Refining, The California Company, Cities Service, American Oil, Hess, Inc.

Iraq Ratifies Agreement

Iraq parliament has ratified a new 50-50 profit sharing agreement with British-controlled Iraq Petroleum Company. The company is jointly owned by Iraq and Anglo-Iranian Oil Company. Premier Nuri Said Pasha, whose Constitutional Unity party controls both houses of parliament, contended that agreement would give Iraq greater oil profits than her neighbors are getting.

Science Report Out

The first annual report of the National Science Foundation, 1950-51 has been published. The foundation was established on May 10, 1950, by an act of Congress, with James B. Conant, president of Harvard University, as chairman. Edwin B. Fred, president of the University of Wisconsin, is vice chairman.

Union Research Center Opens

Union Oil Company officially opened its new $8,000,000 scientific research center at Brea, California, with an open house for the public recently.

The vast center, manned by a selected staff of 300, is practically a city within itself. Each of the modernistic laboratory buildings is as long as a football field, with the north exposure practically solid glass. The administration building, sweeping across the front of the gigantic establishment, is 534 ft long. There are 260 sq ft of floor area for each researcher.

Among the interesting features of the center is the reinforced utility tunnel large enough to drive a truck through and extending in excess of a half mile beneath the buildings. This tunnel system houses pipes carrying gas, steam, water, compressed air, vacuum, waste and electric conduits.

PAD Announces Allotment of Tubular Goods Oil Industry

Priorities assistance for second-quarter 1952 purchases of oil-country tubular goods have gone to 1292 oil and gas operators throughout the country, Secretary of the Interior Oscar L. Chapman, Petroleum Administrator for Defense, announced.

A total of 1835 applications for assistance were received by the deadline for filing. Of these 543 were denied because of defects in the applications or because the operator filing did not qualify for a quota.

There are 282,492 tons of casing and tubing covered by the applications granted by PAD. Of this 197,438 tons will go to so-called B operators—those drilling more than 40 wells in a normal year's operation—and 85,053 tons to A operators—those who drill fewer than 40 wells in a normal year.

In addition 30,000 tons have been assigned to field stocks for use by operators who normally drill from 0 to 8 wells in a year. Another 22,200 tons have been assigned as emergency stocks for use by the A operators in drilling wildcat wells to discover new fields.

Total allotment for the A operators thus comes to 137,253 tons.

More Oil Profits Asked

Oil companies operating on Egyptian soil have been asked for a split of their profits on a 50:50 basis with the Egyptian government. The Petroleum Times has reported that its understanding was the Anglo-Egyptian Oilfields, Ltd., and Socony-Vacuum Oil Company have said they are ready to discuss this. A bill being studied in the Egyptian Cabinet at the present time relaxes the present laws in Egypt in order to facilitate oil prospecting by foreign firms.

Union Oil Company of California opens new $8,000,000 research center at Brea. Insert shows layout of laboratories.

Corpus Christi Chapter of Desk and Derrick Club Organized

Corpus Christi is the latest Texas city to join the Association of Desk and Derrick Clubs of North America. The Gulf city club, was organized with the help of the club in Dallas. Members of the Dallas club, flying to Corpus Christi for the organizational luncheon in that city, presented a panel discussion on the purposes and objectives of the Desk and Derrick Association.

In the photo above, standing, are members of the Corpus Christi planning committee: Margaret Sevier, Taylor Refining; Mary Jo Mireur, Houston Natural Gas; Marie Henderson, La-Gloria Corporation; Bettye Walker, Phillips Petroleum, and Betty Tuck, Southern Minerals. From Dallas, seated: Martha Binford, Seaboard Oil Company of Delaware; Virginia Dupies, Continental Supply; Genevieve Galvin, Magnolia Petroleum; Rosalie Jordan, API's Industry Information Committee: Katheryn Kennell, Lone Star Gas, and Doris Whiteside, Texas Mid-Continent Oil and Gas Association.

Iran Signs Contract With German Communists

Iran and Eastern German Communist government have signed a $28,000,000 contract to enable the Iranian government to run and re-equip the Anglo-Iranian Oil Company wells and refineries with Communist German and Russian help. This will give Russia a direct control over the Iranian oil fields.

Hussein Meliandec, Premier Mohammed Mossadegh's "personal representative" has left the Russian zone of Germany for Moscow after a four-week stay, taking with him the contract for final approval by Russia.

Under terms of the agreement, Iran will get: (1) 1500 Communist German engineers and oil and mining technicians to run the oil fields; (2) 45 per cent of her requirements in explosives and blasting equipment from the Russian zone of Germany, beginning with a shipment of nearly 800 tons next month; and (3) oil well drilling equipment and refining machinery to a total value of $644,000.

In return Russia will be supplied oil for the next 5 years.

In Italy the *Il Tempo*, Italian newspaper, has reported that Italian Middle East Petroleum Company, signed a contract with Iranian National Petroleum Company in Tehran for 2,000,000 tons of petroleum annually for 10 years. Payment for the oil, the newspaper continued, would be in Italian products and services.

The semi-official Iranian newspaper. *Bakhtar Emrooz*, reported some time ago that an Italian company was dickering to buy half a million tons of Iranian oil at $15.24 a ton, about 2/3 of the international price.

Booklet Depicts Economics Of Oil Industry in 1951

"Some Economic Aspects of the Oil Industry in 1951" has been published by the Manchester Oil Refinery Limited and Petrocarbon Limited. Written by Georg Tugendhat, managing director, and Catherine Mackintosh, head of market research, the booklet is issued as a special supplement to the house magazine. It is the first of a series of publications prepared by experts in technical and economic matters concerning the oil industry. Further papers will be presented in a similar manner.

Three factors are forecast in the economic significance of the industry, the authors believe, pointing out that these are: Upheavals in the Middle East; impending completion of the European Refinery Program, together with the possibility of an extension of this work, and the vital importance of oil to national defense.

PAD Publishes Export Figures

The Petroleum Administration for Defense has published its weekly summary of U. S. exports of major petroleum products. Figures below include tanker and barge movements only, in thousands of barrels daily, and are preliminary and subject to change each week. They are a compilation of the export declaration filed with the Census Bureau each week.

Russia-Finland Enter New Oil Agreement

A new agreement reached by the Finnish-Russian Government indirectly confirms latest reports that the Russian petroleum industry has made extensive new finds of oil deposits in the Russian territory. The Gothenburg Trade and Shipping Journal has reported that a dispatch from Helsinki states the Russians have undertaken to supply Finland with 130,000 tons (1,000,000 bbl) of gasoline in 1952. The agreement also states that Russia will supply Finland with 160,000 tons of other liquid fuels (1,200,000 bbl) in 1952.

Russian oil resources have been under considerable discussion lately, as a result of Lavrenti Beria, police and interior minister's, announcement that Russia's oil production would be increased by 13 per cent this year.

It was not indicated in the announcement where the new oil deposits might be. It has been known for sometime, however, that Russian authorities were anxious to locate significant oil reserves outside Baku, where the Russian oil industry is mainly concentrated. This is a particularly perilous strategic position, because of the nearby British bombing bases in Iraq and of United States air bases at Dharan, in Saudi Arabia.

New British Buys Flank Oil

New British Dominion Oil Company, Ltd., Calgary, has reported that it has acquired 100 per cent control of Flank Oil Company of Great Falls, Montana.

T. L. Brook, president of New British, also reported that his company has entered into an agreement with Pacific Petroleums, Ltd., and Peace River Natural Gas, Ltd., covering an option to acquire 50 per cent interest in a block of 20,000 acres in the Peace River area of British Columbia. In return for the 50 per cent interest, New British will deepen the Peace River natural gas No. 8 well from its present depth of 5957 ft to test the Mississippian lime up to a depth of 8900 ft.

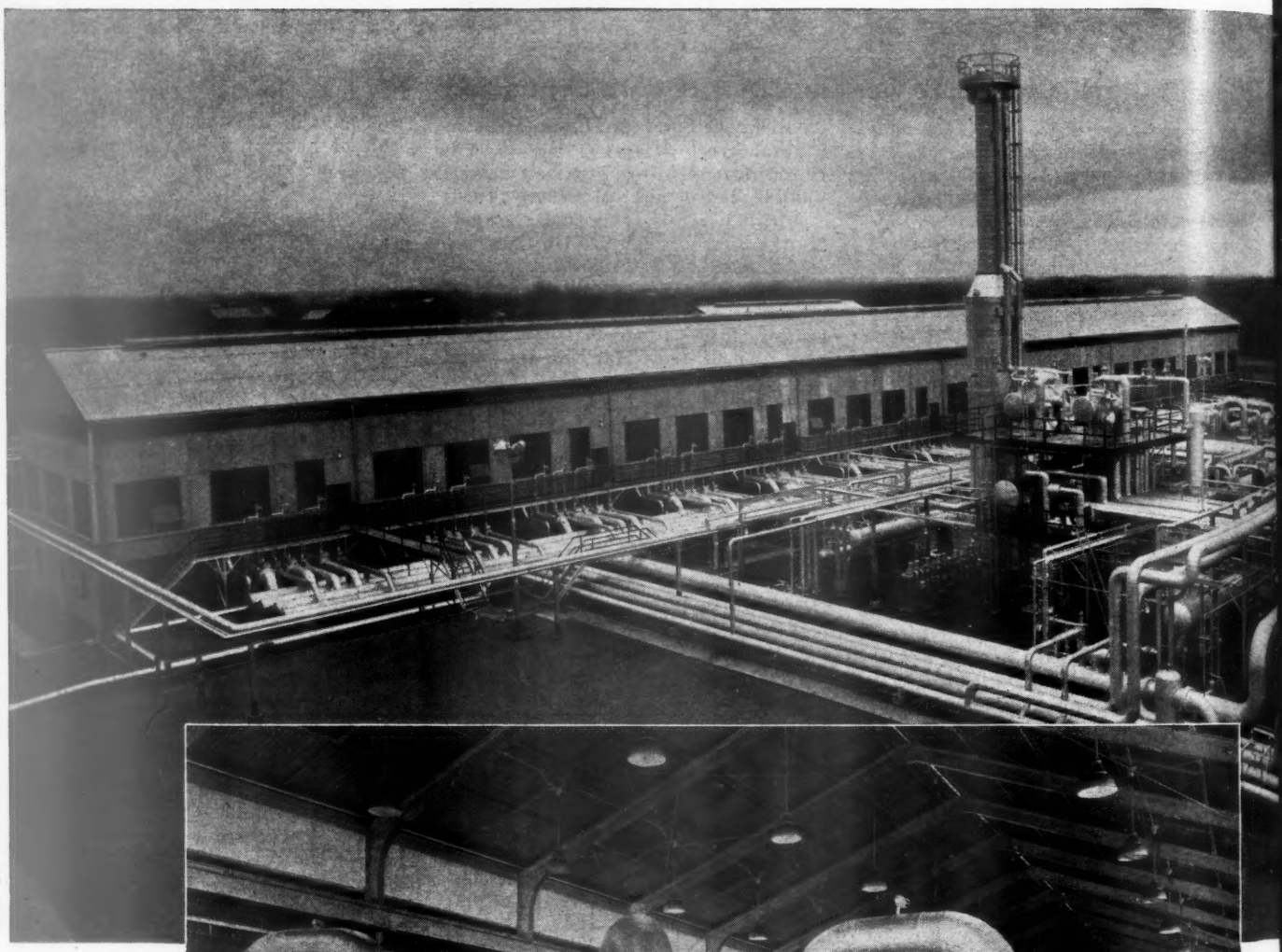
Oil Symposium Set

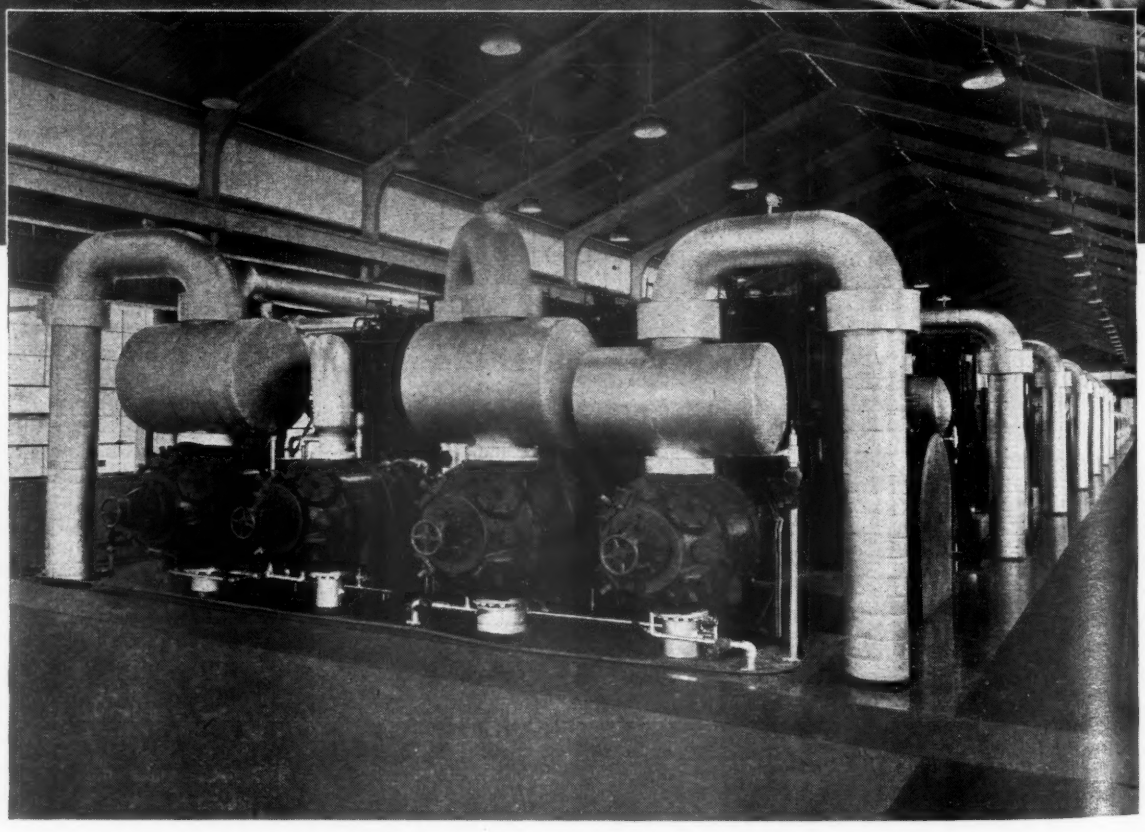
A symposium on oil and gas will be held at the school of law in the University of Kansas City in that city on May 16, the dean of the law school has announced. Subjects to be discussed have been listed as: Unitization, leasing of the public domain, percentage depletion tax problems, and oil and gas royalties. The dean, Marlin M. Volz, announced that prominent persons in the oil industry are being contacted to make presentations at the symposium, which will be open to any persons interested as well as attorneys.

Week ending	Avgas*	Motor gasoline	Kerosine	Distillate	Residual	Total
December 21	35.1	42.3	12.0	28.5	46.9	164.8
December 28	43.0	61.8	0.9	46.4**	71.6	223.7**
January 4	32.4	39.7**	9.6**	95.3**	50.1	227.1**
January 11	—	38.3	1.9	17.0	111.9	169.1

* Avgas is partly estimated and includes all methods of shipment.
** Revised.

Clark "Big Angles"





To obtain more information on products advertised see page E-41

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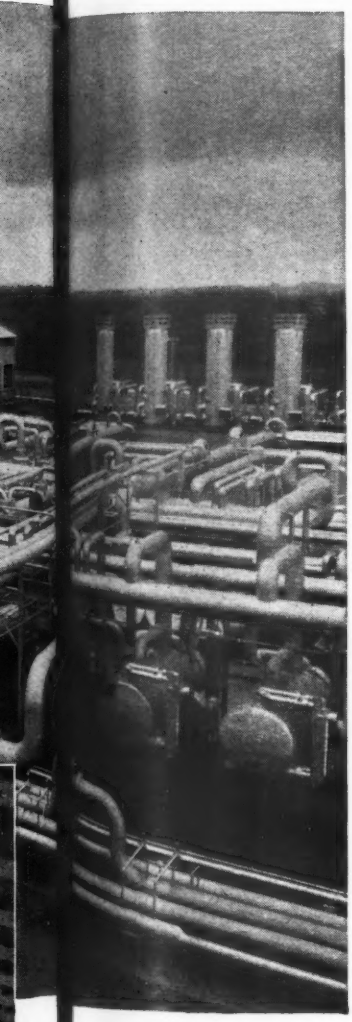

Clark HBA Compressors, Famed for Sustained Fuel Economy and Dependability, Installed in World's Largest Ethane Recovery Plant

Tennessee Gas Transmission Company recently placed in service the largest ethane recovery plant ever built for operation in conjunction with a gas transmission pipeline. In designing the Gabe, Kentucky plant, process requirements dictated the following rigid compressor specifications:

- A total of 23,000 horsepower required
- 1600 to 1800 horsepower units were necessary for proper compressor distribution between the five compression services
- 750,000,000 cubic feet per day capacity
- Four compressor cylinders per unit
- Minimum fuel consumption was necessary because overall economics indicated an "end of the line" high fuel cost, plant location

With over 135,000 horsepower of Clark BA and HBA compressors already operating in their other compressor stations or on order, Tennessee Gas Transmission Co. knew first hand what the "Big Angle" could do. Thirteen Clark 1760 BHP, High Compression "Big Angles" were subsequently installed to handle all compression services in the new plant. These services include propane refrigeration, ethane refrigeration, reactivating gas service, flash gas service and the return of residue gas to the pipeline.

If you are contemplating building a plant involving intricate processing operations, consult your nearest Clark representative. He has the compressor know-how and a complete line of heavy duty compressor equipment to simplify your installation.

For complete details on Clark Big Angles request Bulletin 104

CLARK BROS. CO., INC. • OLEAN, N. Y.
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OFFICES IN PRINCIPAL CITIES THROUGHOUT THE WORLD

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CLARK® compressors

Oil Demand May Level Off

Demand for oil products will level off in the next few years, Dr. Robert E. Wilson, Standard Indiana chairman, believes, and gives five things on which he bases his belief: (1) Increasing use of natural gas; (2) fewer coal furnaces left to convert; (3) most large farms already well mechanized; (4) railroad dieselization is well along, and (5) fewer new automobiles in next two years.

Esso Publicity Moves

Esso Standard Oil Company has announced a new address for its public relations department. Offices are now in Rooms 2531-2541, Esso Building, 15 West 51st Street, New York City.

Stanolind Fellowships

Stanolind Oil and Gas Company has announced the establishment of 14 fellowships for advanced study and research in various fields of petroleum science at 12 colleges and universities.

Thompson Speech Published

Dresser Industries, Inc., Dallas, Texas, has published a brochure containing Lieut. General Ernest O. Thompson's speech "Freedom's Oil," given before the American Petroleum Institute in Chicago, Illinois, November 7. The brochure contains many pictures and a replica of the gold medal for distinguished achievement, awarded him by the API at its annual meeting last year.

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Thompson does a double duty job and does it better: (1) by removing destructive shale and abrasives from your drilling mud, it saves you money because unnecessary wear and tear on costly drilling equipment is reduced to a minimum, and (2) the Sample Machine (standard equipment) gives an accurate analysis of the progress of the well by collecting foot-by-foot cuttings. Thompson Separators are self-motivated, activated by the mud flow. Make Thompson a part of your standard drilling equipment.

★ PROVEN PERFORMANCE
★ ECONOMICAL OPERATION
★ SAVES DRILLING COSTS

Rodgers Terms Figures on Oil-from-Coal Misleading

Heading the National Petroleum Council's dispute with the government over the latter's report that gasoline and other fuels could be produced from coal cheaply enough to compete with petroleum is W. S. S. Rodgers, chairman of The Texas Company. In a report to the NPC by Rodgers, who is also head of the Council's committee on synthetic liquid fuels production costs, concluded that the recent Bureau of Mines cost figure of 12 cents a gallon for gasoline made from coal is "misleading."

The National Petroleum Council report differs with the Bureau of Mines on four major points:

The Bureau's estimate of investment costs is $121,500,000 less than the Council's.

Bureau estimates for operating labor and maintenance costs are $10,768,000 per year less than the Council figures.

With reference to estimating revenue, the Council study said, "The plant proposed in the latest Bureau of Mines report cannot be classified as a liquid fuels venture because the chemicals produced account for more than half the total revenue."

The Council report also held that the Bureau had overstated its product revenue.

In differing with the Bureau's figures covering return on investment, the report emphasized that manufacturing costs alone, as estimated by the Committee, amount to 20 cents a gallon without allowance for interest, income taxes, and return on investment. As the average wholesale price of gasoline refined from crude oil is approximately 12 cents a gallon, the report pointed out that there would be no profit to be applied to any capital, borrowed or equity.

On the side of the government Dr. W. C. Schroeder, assistant director of the U. S. Bureau of Mines, reports that he is standing by his first statement that gasoline made from oil shale and through the coal hydrogenation process (coal to oil) could sell profitably at the refinery at 11.2 to 12 cents per gallon. He expects to have figures to prove this in the near future.

Annual Short Course Set In Gas Technology

The seventh annual short course in gas technology, offered by the Texas College of Arts and Industries and sponsored by the Southern Gas Association, will be held May 29, 30, and 31, 1952, at Kingsville, Texas.

The short course will cover problems encountered in the production, transmission, and utilization of gas and will see the gas industry's leading national figures discussing these problems. The enrollment will be limited to 200. Classroom work will be supplemented by field and laboratory demonstrations. The complete program for the course will be released on April 1, 1952.

PIEA-PESA Set Joint April Meet in Tulsa

A four-day program covering many phases of the use of electricity in the oil and gas industry will be conducted here April 14 to 17 by the Petroleum Industry Elecrical Association and the Petroleum Electric Supply Association.

F. P. (Pat) O'Connor, Service Pipe Line Company, chairman of the publicity committee, said that approximately 700 oil industry and pipe line people are expected to attend. Headquarters will be in the Mayo Hotel.

M. C. Callahan, Gulf Refining Company, pipe line division, general chairman of the conference, said this would be the PIEA's 24th meeting. The organization is an association of all branches of the petroleum industry having telephone, telegraph, radio or electrical departments.

The program follows:

Monday, April 14: Directors' meeting; preconference luncheon; open meeting, PIEA-PESA; business meetings, PIEA-PESA.

Tuesday, April 15: "Coordination of Petroleum and Power Company Problems", W. H. Stueve, consulting engineer; "Oil Field Distribution Systems," B. L. Moore, Humble Oil & Refining Company; "Microwaves in Operation", C. B. Lester and C. A. Compton, Mid-Valley Pipe Line; Message from Federal Communication Commission; business meetings, PIEA-PESA.

Wednesday, April 16: "Refinery Distribution Systems", T. R. Shaw, Phillips Petroleum; "Is Present Design of Equipment for Hazardous Locations Practical or Economical", R. J. Osborn and Glenn Ladd, Sinclair Pipe Line.

Corrosion section luncheon and round table discussion; "Operating Techniques of FM Communications", C. W. Evans and W. H. Craig, United Gas Pipe Line; "Tone Coding—Directional Antennae—Industrial TV Application" R. C. A.; PIEA — New Board of Directors' meeting; annual banquet.

Thursday, April 17: "Utilization of Company Owned Wire Line Facilities", H. L. Wheeler, Service Pipe Line; "Chemical Brush Control", Homer L. Jacobs, Davey Tree Expert Company; "Frequency Measurement Techniques", Len Cutler, Gertsch Products, Inc.; "The Supervisors' Responsibility in Safety", Don Attaway, Arkansas Fuel Oil Company.

Oil Convention Postponed

The executive committee of the VII Convego Nazionale del Metano e del Petrolio (National Petroleum Convention—Italy) has reported it has postponed its meeting date to April 21-24.

Propose Bigger and Faster Oil Tankers

The Maritime Administration has announced plans for speedier and better ocean-going oil tankers. A tentative program, not yet gone to Congress, calls for an estimated $100,000,000 to construct 10 tankers of 20,200 deadweight tons each and a cruising speed of 20 knots. This would make capacity of each tanker approximately 150,000 bbl—after bunker space and speed are taken into consideration, and the speed would approximate 23 miles an hour.

Standard Proposes Changes In Elk Hills Contract

Captain R. H. Meade, CEC, USN, director of Naval Petroleum Reserves, announces that the Standard Oil Company of California has proposed major changes in the contractual relationship between Standard and the Navy at the Elk Hills Naval Petroleum Reserve.

Captain Meade said that no change in the existing contract could be made without approval of the Secretary of the Navy, the Department of Justice, the Congress and the President, inasmuch as the Naval Petroleum Reserves are operated under special legislation, which assures public review of any important changes in policy or procedure.

Addresses D & D Chapter

Marshall Newcomb, general counsel for Lone Star Gas Company, spoke before the Dallas Desk and Derrick Club recently. His talk covered powers and duties of the Federal Power Commission and the Texas Railroad Commission in their regulation of the petroleum industry.

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Salaried position commensurate with experience; location in Boston. In reply please state educational qualifications, work experience (mentioning types of instruments), salary requirements and date available.

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One of leading integrated manufacturers of wire rope seeks mature engineer familiar with rotary drilling equipment particularly, and possessing inherent desires and personality to sell. Initial location to be in Rocky Mountain area servicing oil fields; however, future opportunities are unlimited, depending upon the man. Remuneration dependent upon experience, etc. If interested write this periodical, care Box 133, giving full details on education, experience, salary desired, etc. Your inquiry will be held in strict confidence. Our organization knows about this advertisement.

Petroleum Service Engineer

Manufacturer of refinery maintenance and reconditioning materials has an opening for a Petroleum Chemist, General Foreman, or Maintenance Supervisor for technical service to the petroleum industry.

The position will entail considerable travelling, primarily in the West Coast area, doing field work with local representatives assisting them with their sales and product application in petroleum industries.

Applicants must be 30 to 40 years of age, know chemical and mechanical processes and equipment and have experience in operating or refinery engineering.

Reply giving full details of education, experience and personal status to F. B. Johnston, Box P.E.M. No. 2, Room 801, 117 Liberty St., New York 6, N. Y.

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1951 Imports Up 10,000 Bbl a Day From 1950

Oil and products imported into the U. S. in 1951 averaged 850,000 bbl daily, an increase of 10,000 bbl daily from the 1950 average, according to a Census Bureau report. Oil imports alone averaged 487,000 bbl daily in 1951, compared with 472,000 bbl daily in 1950. Residual fuel oil imports averaged 332,000 bbl daily in 1951, down slightly from the average of 334,000 bbl daily in 1950.

Total imports average for the four weeks ending February 9, as reported by the American Petroleum Institute are as follows:

Week Ended	Crude Oil	Residual Oil	Others	Total
	(Figures in barrels per day)			
January 19	490,700	495,600	24,400	1,010,700
January 26	530,200	356,200	21,400	907,800
February 2	438,500	428,500	13,200	932,700
February 9	527,600	291,800	14,800	834,200
4 weeks average				
496,800	393,000	393,000	21,500	911,300

English Instrument Group Holds 8th Annual Luncheon

By increasing productivity, British industry can close the door to the infiltration of the Communist cold war into our national life, Sir Norman Kipping, J. P., director-general of the Federation of British Industries, told members of the British Industrial Measuring and Control Apparatus Manufacturers' Association at their eighth annual luncheon in London. Sir Norman, who is a Commander of the Order of Dannebrog, into which Captain Carlsen is to be appointed, compared the "Flying Enterprise" with "Private Enterprise" in his country and observed that in each case it was the quality of the *man* that was important. He also referred to the fact America was going to assist England to meet its requirements for steel.

Last Day at Camp. This group of boys, gathered around their tent, talk with R. M. Pyles, founder of three camps for underprivileged boys and girls. The camp project has been going on since 1949 under the sponsorship of the oil industry.

Socony-Vacuum Makes Large Gift to Columbia

An "investment" of $100,000 in the $22,150,000 Columbia University Engineering Center has been made by the Socony-Vacuum Oil Company, Inc.

In a statement that accompanied the gift, George V. Holton, chairman of the board of the Socony-Vacuum Oil Company, emphasized that the gift "was not considered so much a gift as an investment." "We of private industry—and especially of the oil industry—depend to a great extent upon the advancement of technology and upon adequate, well-trained engineering personnel. A serious shortage of engineer-scientists exists today. I understand it can be much worse tomorrow, unless there is a rapid increase in training facilities," he said.

Members of British Industrial Measuring and Control Apparatus Manufacturers Association at annual luncheon in London.

U. S. Oil Annual Incomes High Before Taxes

Outstanding economic characteristic of the petroleum industry in the U. S. is the large amount of earnings reinvested in the business, is the opinion of Frederick G. Coqueron and Joseph E. Pogue, petroleum department, Chase National Bank. Thirty major oil companies reinvested $19.4 billion in property, plant, and equipment out of cash earnings amounting to $25.2 billion during the 17-year period 1934 to 1950, Pogue and Coqueron revealed. Some $5.6 billion were paid to shareholders.

In a report to the petroleum branch of American Institute of Mining and Metallurgical Engineers Pogue and Coqueron expressed their opinion that the reported net income of the oil business has been overstated in recent years because funds set aside from income for replacement of assets have been far below present high replacement costs. The industry has been selling its low-cost productive assets, particularly crude oil reserves, and has been taking the profits into operating income and paying taxes on it without proper provision for replacement at current inflated costs.

Some of the reports of annual earnings for 1951 are as follows:

Sunray Oil Company had a net income of $24,255,000 in 1951, as compared with $20,462,000 income for the previous year. Gross income amounted to $126,000,000 in 1950.

Ohio Oil Company reported that although definite figures were not available it expected its 1950 income to be the second highest in the company's history, exceeding $6 per share.

Phillips Petroleum Company announced its company's net income for last year was approximately $73,700,000, compared with $51,500,000 for 1950, an increase of about 43 per cent.

Sun Oil Company and subsidiaries reported a consolidated net income of $45,352,974 for 1951, after setting aside reserves for depreciation, amortization, depletion, and Federal Income Tax. This compares with a net income for the year 1950 of $36,291,498.

March Oil Output in Texas Set at New High

Texas is producing a record 3,131,429 bbl of crude oil daily this month, about 34,429 bbl daily higher than the average last month. The new record allowables set by the Texas Railroad Commission is about 5000 bbl higher than the record set last October. Ralph J. Dietler of Tulsa, vice president of Stanolind Oil Purchasing Company, reported that the company is suffering from a surplus of sour crude, and added that market demand actually is less than "nominations" because his company is buying 18,000 bbl of crude daily that it does not need.

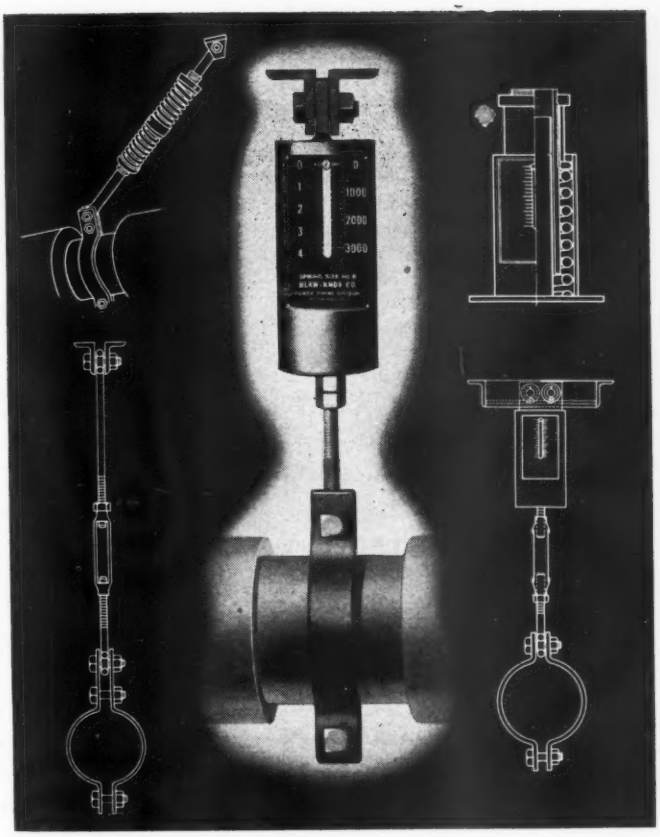
Several companies, however, supported the Commission's decision to raise the March production rate to a new high. Joe Brown, of Houston, speaking for Gulf Oil Corporation, stated "We have a firm demand for every barrel this would bring us, and we could use more." Joining Stanolind in the request for cutting the output were Magnolia, Cities Service, and Texas Companies.

More Steel Needed to Meet 1953 Schedule

The oil industry will need about twice as much steel as it is now getting if it is to meet the expanded program set up by the Petroleum Administration for Defense, Interior Secretary Chapman has declared. He said enough steel was expected to be available for the year for drilling about 44,000 wells, but if the nation's output is to be increased by 642,000 bbl daily by 1953—PDA goal—there will have to be 83,000 new wells.

Gas Tax Trial Set This Month

Scheduled this month is a court test of the new Texas gas "gathering" tax, effective September 1, 1951. Main question to be discussed is the constitutionality of the state's levy on gas that goes into interstate commerce. District Judge Roberts has agreed to take up one or more of the 42 cases filed by all but 3 of the 29 lines carrying Texas gas into other states. Most of the companies have filed suit to recover the money already paid. The tax, if allowed to stand, would bring about $12,000,000 to $14,000,000 to the state each year. Levy is 0.45-cent a thousand cubic feet.



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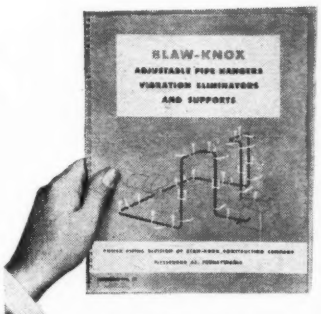

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Personals

I. C. (Cleve) Huff, Jr., has been named assistant to the executive manager of the Independent Petroleum Association of America, which he joined as a field representative in 1941. His appointment to the newly-created post was announced by C. E. Buchner, executive manager, who said Huff would assist with IPAA administrative duties and direct activities of its field staff.

Huff was field representative of IPAA at Houston, Texas, from 1941 until September, 1950, when he was transferred to the Tulsa headquarters as membership director. He completed a private secretarial and bookkeeping course at Tyler Commercial college in 1928, following which he joined Pawnee Oil Production Company as bookkeeper. Prior to joining IPAA, he was office manager for Cree and Hoover drilling contractors and oil producers, Pampa, Texas, for several years.

Dale R. Snow, a vice president and director of Sunray Oil Corporation, is resigning his position as an active officer of the company because of his desire to devote more time to his personal interests. He will remain a member of Sunray's board of directors and will have an office with Sunray in the First National Building in order to serve in a consulting capacity.

After graduation from University of Chicago in 1916, Snow worked briefly for the old Roxana Petroleum

Dale R. Snow

Corporation, served in the U. S. Army during World War I, and in the geological department of the old Marland Oil Company in 1919. He joined the Waite Phillips organization in 1920 as chief geologist and when that company was merged into the former Barnsdall Oil Company in 1925, he became chief geologist and manager of exploration for Barnsdall. In 1936, Snow became a director and general manager of all the Mid-Continent operations of Barnsdall. When Barnsdall merged into Sunray Oil Corporation in the summer of 1950, Snow was elected a director and a vice president of the merged and enlarged corporation.

A. W. Ambrose

S. B. Irelan

George M. Cunningham

A. W. Ambrose, president of Cities Service Oil Company of Delaware, with headquarters at Bartlesville, Oklahoma, has been named chairman of the board of that company. Succeeding Ambrose in the presidency will be **S. B. Irelan,** since 1944 president of the Cities Service Gas Company with headquarters in Oklahoma City. Irelan will be succeeded in the presidency of the gas company by **Glenn W. Clark,** since 1944 vice president and general counsel of that subsidiary.

By assuming the chairmanship and turning over to Irelan the administrative direction of the company, Ambrose can devote his principal attention to the extensive exploration and production activities in both the domestic and foreign fields, Jones said.

Irelan has been associated with Cities Service since 1909 and has been for many years a key executive in the management of various Cities Service properties in the electric utility, natural gas, and petroleum fields.

George M. Cunningham has been selected to head the newly-formed American Overseas Petroleum, Ltd., Standard Oil Company of California, has announced. The new corporation is jointly owned by Standard Oil Company of California and The Texas Company.

Cunningham, who becomes president of American Overseas, has served as general manager of Standard's exploration department since 1946. He had previously been chief geologist of the company's producing department.

O. F. Van Beveran has been named by Standard to replace Cunningham as general manager of exploration. He has been assistant manager of the company's exploration department for the past year.

Michael L. Haider, vice president, of Imperial Oil, Ltd., Toronto, a Standard Oil of New Jersey Company affiliate, formally took over duties as president of the American Institute of Mining and Metallurgical Engineers at their annual convention in New York City on February 19. With him were installed the following new vice presidents: **O. B. J. Fraser,** assistant manager of development and research for International Nickel Company, and J. B. Morrow, retired vice president of Pittsburgh Consolidated Coal. New directors are: **C. H. Benedict,** who has retired from active services as metallurgist for Calumet and Hecla Consolidated Copper; **R. B. Caples,** manager of Anaconda Copper's Great Falls electrolytic plant; **T. B. Counselman,** of the Dorr Company; **T. L. Joseph,** assistant dean, Institute of Technology, Minnesota School of Mines and Metallurgy; and **C. E. Reistle, Jr.,** member of the board of Humble.

Donald M. Cameron, assistant general manager for Esso Standard Oil, S. A., western region, has been transferred from the Isthmus to San Juan, Puerto Rico. His household goods, automobile, and personal effects were carried nonstop across the Caribbean by two Pan American World Airways cargo clippers. Cargo included 167 pieces of furniture and the car.

H. J. McCusker has been elected treasurer of Cities Service Company to succeed Ernest H. Johnston, retired. McCusker has been assistant treasurer since 1942. Johnston has been associated with Cities Service for 45 years. He has been a member of the board of directors since 1916, and became treasurer in 1945.

John I. Richardson has been promoted from the New York to the Minnesota-Dakotas district office of the Oil Industry Information Committee. Richardson, who had been administrative assistant in the field operations office, is now the second district representative in Minneapolis, working with senior district representative, John C. Reidy.

John Q. Weatherly and **Herman P. Pressler** have been appointed associate general counsels of Humble Oil and Refining Corporation and assistants to Rex G. Baker, general counsel for the company.

▸ **Wallace B. Mathews** has been appointed co-ordinator of engineering and engineering research, Standard Oil Company (Indiana). **Wilbur G. Guild** and **Ben Franklin** have become assistant chief engineers and **Robert R. Penman** has been appointed head engineer. Mathews, formerly assistant chief engineer in the general office, joined Standard in 1923. He is a graduate in mechanical engineering from the University of Illinois, and a member of the American Society of Mechanical Engineers.

Guild, who has been assistant chief engineer of the company's engineering department at Whiting, Indiana, came to Standard in 1930. A graduate of Illinois Wesleyan, he also holds degrees from the University of Illinois.

Franklin, formerly assistant to the chief engineer in the general office, holds bachelor's and professional degrees in civil engineering from Armour Institute. He joined Standard in 1929. Penman, who has been head engineer of the engineering department at Whiting, was graduated from the University of North Dakota and University of Illinois. He joined Standard in 1940.

O. E. Wachholz has been appointed chief accountant in the comptroller's office. **J. W. Redding** has become office manager at the Whiting, Indiana, refinery. **W. A. Cunningham** has been made office manager and **F. C. Schield** assistant office manager of the manufacturing accounting division in the general office.

Wachholz, who joined the company in 1921 and became assistant chief accountant last year, succeeds the late George B. Anderson. Redding has been office manager, Cunningham, assistant office manager, and Schield, supervisor of the yield and cost section, all in the manufacturing accounting division.

Walter S. Hallanan

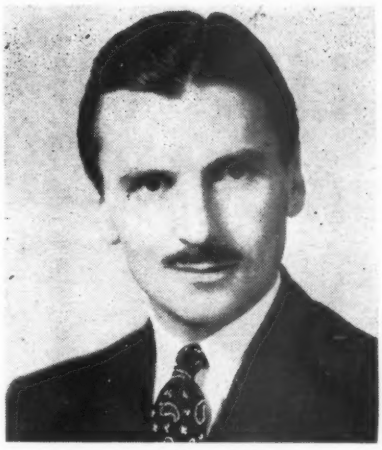
▸ **Walter S. Hallanan,** president of Plymouth Oil Company, has been re-elected to serve his sixth term as chairman of the National Petroleum Council. **R. G. Follis,** chairman of the board of Standard Oil Company has been re-elected vice chairman of NPC.

▸ **A. W. "Bob" Gentry,** supervisor of operations for Long Beach Oil Development Company has resigned his position with that organization to take over as manager of field operations for Fullerton Oil Company.

Menneer Joins The Petroleum Engineer Staff

Jack Menneer has joined the editorial staff of the *Drilling and Producing* edition of *The Petroleum Engineer*. Educated at Truro School, he was graduated from the Camborne School of Metalliferous Mining, Cornwall, England, with an A.C.S.M. degree. He is an Associate of the Institute of Mining and Metallurgy, London. He saw six years of active service with the British Army in World War II as a Captain in the Royal Engineers.

Menneer spent three and one-half years with the Shell Group as an exploitation engineer, working in Holland, and in Colombia and Venezuela, South America. From January 1951 to date Menneer has served as a petroleum engineer with the Magnolia Petroleum Company in the Gulf Coast Division Office at Houston, Texas. His experience covers petroleum engineering duties in field development, drilling, and producing operations.



Jack Menneer

He will make his headquarters in Dallas.

DEATHS

▸ **William G. Blaisdell** died February 3 in Uniontown, Pennsylvania. He began working in the oil fields of Pennsylvania as a rig builder at the age of 19, and later entered into production work. Blaisdell went to Oklahoma in 1922 and worked for Skelly Oil and then Marland Oil Company. He moved to Texas in 1929 and worked for Bob Dunlop, who later sold out to Kewanee Oil Company. He was Kewanee superintendent until he retired in 1944.

▸ **Harry J. Kelly,** who on December 31, 1951, retired as manager of construction and maintenance division of the manufacturing department of Gulf Oil Corporation, died suddenly January 21. He received a Bachelor of Science degree in Civil Engineering from Texas A. and M. College in 1911. His association with the Gulf companies began in 1916.

In mid-summer of 1930, Kelly became assistant manager of the company's engineering department. When this department was decentralized in January 1950, he was appointed manager of construction and maintenance division of the manufacturing department.

▸ **F. E. Lacaze,** 63, died at his home in Shreveport, Louisiana, in January, following an extended illness. He was an employee of United Gas Pipe Line Company and its predecessor firms for more than 37 years. He was Shreveport district superintendent of Atlas Oil and district manager for United Gas from 1919 until his retirement in May, 1949.

Lacaze was born in Shreveport October 13, 1888, attended public school, St. John's High School, and a business college there. In 1912 he entered the service of Atlas Oil Company to begin his 37-year tenure with the United Gas companies.

On May 10, 1918, Lacaze enlisted in the Signal Corps Depot Battalion for service in World War I, and his army duty took him overseas from August of 1918 until June of the next year. Upon discharge from the armed forces, he returned to Shreveport, where he was made district superintendent for Atlas Oil. United Gas was organized in 1930, and in 1934 he became Shreveport district manager for the firm.

▸ **Emma E. Crandal,** distinguished literature chemist in the field of petroleum, died recently. Miss Crandal established Universal Oil Products Company's library at Riverside, Illinois, over which she presided for 20 years until her retirement in 1945. During the same period she established, and was compiler and editor of the company's "Library Bulletin of Abstracts," a weekly publication dealing with research on petroleum and pure hydrocarbons with worldwide distribution.

She graduated in 1893 from Tri-State Normal College in Angola. After teaching mathematics in the Angola High School for some years, she studied and obtained her A.B. degree in chemistry from Cornell University in 1911. She was then employed by the U. S. Rubber Company in Hartford, Connecticut, and later by Universal Oil Products.

▸ **Miss Eugenia Banks** died recently after suffering a cerebral hemmorhage. She had been employed in the production department of the General Petroleum Corporation for the last 28 years and was well known in the West Coast oil industry. Her late father, Frank S. Banks, was the first general production superintendent of General Petroleum. Miss Banks had held the post of secretary to the vice president and director of production nearly 20 years.

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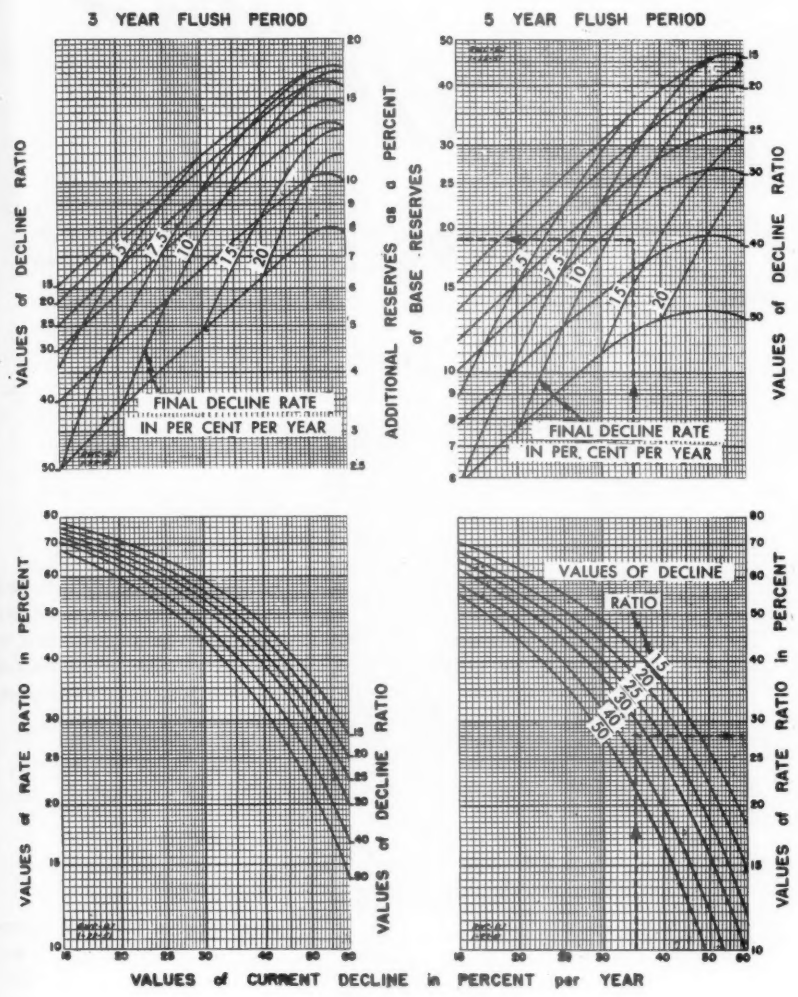

3 YEAR FLUSH PERIOD
5 YEAR FLUSH PERIOD
VALUES of DECLINE RATIO
ADDITIONAL RESERVES as a PERCENT of BASE RESERVES
FINAL DECLINE RATE IN PER CENT PER YEAR
FINAL DECLINE RATE IN PER. CENT PER YEAR
VALUES of RATE RATIO in PERCENT
VALUES of DECLINE RATIO
VALUES OF DECLINE RATIO
VALUES of CURRENT DECLINE in PERCENT per YEAR

CHART 7

APPENDIX A

SUMMARY of FORMULAE

DEPENDENT VARIABLE			CONSTANT DECLINE		VARIABLE DECLINE		
DESCRIPTION	SYMBOL	UNITS	NO.		NO.	$n \neq -1$	$n = -1$
BASIC EQUATION: PRODUCTION RATE at TIME t	Q	B/D	II	Ad^t	VII	$A\left(\frac{1}{t}\right)^n$	$A\frac{1}{t}$
RATE of DECLINE at TIME t	D	%/YEAR		D (Const.)	VI	$\left[1-\left(\frac{t+1}{t}\right)^n\right]100$	$\frac{100}{t+1}$
RATE of DECLINE at TIME t	r	B/D/YEAR	IV	$A \cdot \ln d \cdot d^t$	IX	$A \cdot n \cdot \frac{-n-1}{t^n}$	$-A\frac{1}{t^2}$
TIME from t_1 to LIMIT	T	YEARS	III	$\frac{\log W}{\log d}$	VIII	$t_1(V-1)$ or $t_1(W^{\frac{1}{n}}-1)$	$t_1(V-1)$ or $t_1(\frac{1}{W}-1)$
REMAINING RESERVES per CURRENT BARREL	S/A	BBLS.	V VI	$\frac{365}{-\ln d}(1-d^T)$ $\frac{365}{-\ln d}(1-W)$	X	$\frac{365}{n+1}t_1(V^{n+1}-1)$ or $\frac{365}{n+1}t_1(W^{\frac{n+1}{n}}-1)$	$365\,t_1 \ln V$ or $365\,t_1 \ln \frac{1}{W}$
RELATIONSHIP of $t_1, T, D_1, \& D_2$					XII	$\frac{t_2+1}{t_1} = \left(\frac{t_2+T+1}{t_2+T}\right)^Z$ where $Z = \frac{\log(1-D_2 \times 10^{-2})}{\log(1-D_1 \times 10^{-2})}$	
DISCOUNT FACTOR	R	PERCENT	XIII	$\frac{\ln d}{\ln d'} \times \frac{(1-d'^T)}{(1-d^T)} \times 100$			

Basic Equation;

2. $Q = Ad^t$

Solution for T: Economic life or time to limit in years:

Let rate ratio $W = L \div A$

$L = Ad^T$ and

$$3.\ T = \frac{\log W}{\log d}$$

Solution for r: Decline rate in barrels per day per year.

$$4.\ r = \frac{dQ}{dt} = A \cdot \ln d \cdot d^t$$

Solution for S: Economic or remaining reserves in barrels:

$$S = \int_{t_1}^{t_2} Q\,dt$$

$$5.\ \frac{S}{A} = \frac{365}{-\ln d}(1 - d^T)$$

As T increases:

$\frac{S}{A}$ approaches $\frac{365}{-\ln d}$ as a limit.

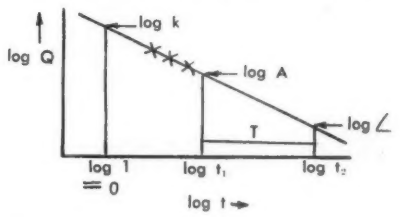
$$6.\ \frac{S}{A} = \frac{365}{-\ln d}(1 - W)$$

When $W = 0$:

$$\frac{S}{A} = \frac{365}{-\ln d}$$

APPENDIX E

Derivations—Variable Decline



Let

Q = Production rate at time t in barrels per day,

K = Production rate when $t = 1$

A = Production rate at time t_1.

Assume constant slope n of straight line above, then

$$n = \frac{d \log Q}{d \log t} = \frac{dY}{dX}$$

integrating

$$\log Q = n \log t + C$$

when $\log t = 0$, $C = \log K$

$$\log Q = n \log t + \log K \quad \text{and}$$

Basic equation:

$$7.\ Q = Kt^n \text{ or } Q = A\left(\frac{t}{t_1}\right)^n$$

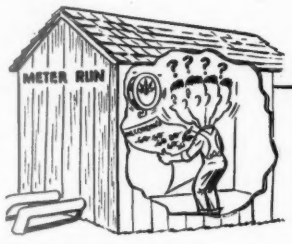
Solution for T: Economic life or time to limit in years in terms of rate ratio W:

How to solve your

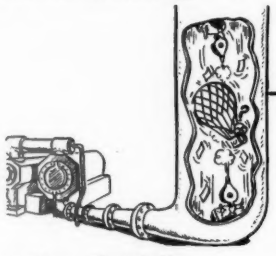
Surge Problems

in gas and air piping

vibration



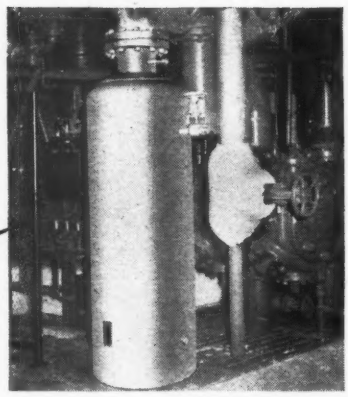
inaccurate metering



fluctuating fluid flow

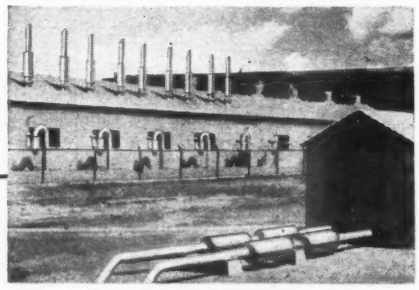
Solved by BURGESS-MANNING

Gas and Air Line Snubbers



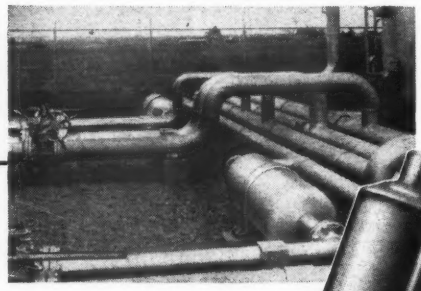
Vibration Elimination

Burgess-Manning Gas and Air Line Snubbers reduce vibration in all lines due to the intermittent suction or discharges of compressors, blowers, or pumps.



Accurate Metering

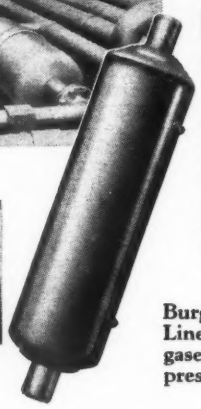
Application of Burgess-Manning Snubbers to meter runs reduce surge which greatly improves the accuracy of meter readings and operation of pressure and flow controls.



Smooth Fluid Flow During Processing

Constant fluid flow is vital to many petroleum and chemical processes. Burgess-Manning Snubbers reduce the exciting force at the beginning of the pipe line to prevent the mass of gas from oscillating.

Write for Bulletin "Surge Control in Gas and Air Piping."



Burgess-Manning Gas and Air Line Snubber . . . Handles all gases and mixtures of gas with pressures to 5000 psi.

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$$L = K t_2^n$$

$$A = K t_1^n$$

and $$W = \left(\frac{t_2}{t_1}\right)^n = V^n$$

where V = "time ratio"

$$T = t_2 - t_1 = t_1 (V - 1)$$

$$T = t_1 (W^{\frac{1}{n}} - 1)$$

Solution for r: Decline rate in barrels per day per year.

$$9.\ r = \frac{dQ}{dt} = An \cdot \frac{t^{n-1}}{t_1^n}$$

Solution for S: Economic or remaining reserves in barrels.

$$S = \int_{t_1}^{t_2} Q dt$$

For cases except when $n = -1$

$$\frac{S}{A} = \frac{365}{n+1}\left(\frac{t_2^{n+1}}{t_1^n} - t_1\right)$$

$$Xa \cdot \frac{S}{A} = \frac{365}{n+1} t_1 (V^{n+1} - 1)$$

$$Xc \cdot \frac{S}{A} = \frac{365}{n+1} t_1 (W^{\frac{n+1}{n}} - 1)$$

When $n = -1$

$$\frac{S}{A} = 365\ t_1\ (\ln t_2 - \ln t_1)$$

$$Xb \cdot \frac{S}{A} = 365\ t_1 \ln V$$

$$Xd \cdot \frac{S}{A} = 365\ t_1 \ln \frac{1}{W}$$

Note:

When $n < -1$

as V increases or

as W decreases

$\frac{S}{A}$ approaches $-\frac{365\ t_1}{(n+1)}$

as a limit

Solution for relationship between:

Current decline rate	D_1
Final decline rate	D_2
Decline ratio	U
Time to limit	T
Slope of projection	n
Value of current time	t_1

Let

d = decline factor as defined in appendix D

$d = 1 - D \times 10^{-2}$ in which

D = Rate of decline in per cent per year.

$$11.\ d = \frac{Q(t+1)}{Q_t} = \left(\frac{t+1}{t}\right)^n$$

$$n = \log d_1 \div \log\left(\frac{t_1+1}{t_1}\right)$$

$$n = \log d_2 \div \log\left(\frac{t_1+T+1}{t_1+T}\right)$$

$$\frac{\log d_1}{\log d_2} = Z = \frac{\log (t_1+1) - \log t_1}{\log (t_1+T+1) - \log (t_1+T)}$$

$$12.\ \frac{t_1+1}{t_1} = \left(\frac{t_1+T+1}{t_1+T}\right)^Z$$

APPENDIX F

Derivations—Discount to Present Worth

Equation V:

$$\frac{S}{A} = \frac{365}{\ln d} \cdot (1 - d^T)$$

is a form that can be used conveniently to reduce future income to present worth. This is not a banker's method: In effect each increment of declining production is reduced to present worth, on the basis of interest converted annually.

Basic equation: $Q = Ad^t$

Present value: $Q' = A\left(\frac{d}{1+i}\right)^t$ (discounted barrels)

where i = rate of interest as a decimal, and

$$Q' = Ad'^t$$

Equation V converts to

$$\frac{S'}{A} = \frac{365}{\ln d'} \cdot (1 - d'^T)$$

Let R = discount factor

$$R = \frac{\frac{S'}{A}}{\frac{S}{A}} = \frac{\ln d}{\ln d'} \cdot \left(\frac{1 - d'^T}{1 - d^T}\right)$$

Note: On Chart 8, lines have been inserted for "Zero decline." For comparison, these are based upon the standard formula for present value of an annuity:

$$\frac{1 - (1+i)^{-t}}{i}$$

It will be noted that the discount values in this case are slightly less than those of the formula for R. This difference arises because the formula for R assumes the present value of the sum of every increment of production (or income) as it is produced, as opposed to the present value of production accruing to and being paid for at the end of each year.

Acknowledgment

Acknowledgment is given R. J. Fernandes and R. E. Martin for constructive suggestions and criticism; and also to Richfield Oil Corporation for their permission to publish this paper.

* * *

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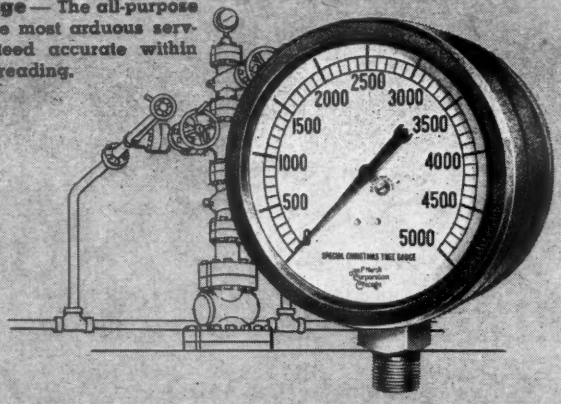

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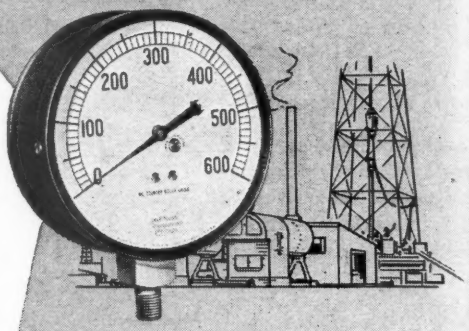

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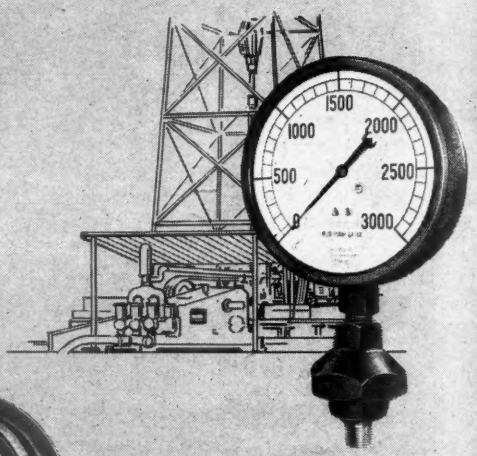

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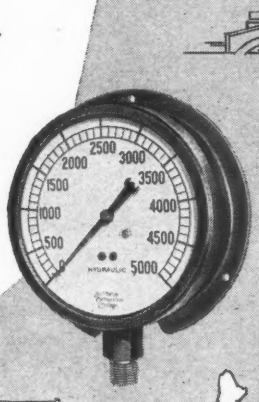

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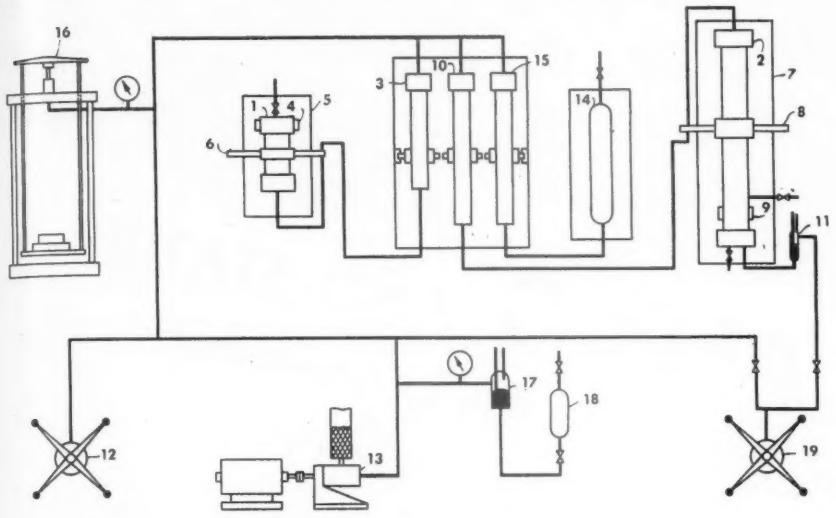

FIG. 1. Diagram of apparatus for phase studies on hydrocarbon systems.

PHASE BEHAVIOR of Hydrocarbon Systems

M. R. DEAN* and FRED H. POETTMANN*

THE increase in the depth, and thus the range of temperature and pressure, at which hydrocarbon reservoirs are being discovered has necessitated the design and construction of apparatus that will accurately measure the physical properties of the reservoir fluid found at these depths. These fluids are often of the gas-condensate type and are usually characterized from a practical standpoint by the following three criteria.

1. The stock tank liquid usually has an API gravity at 60 F of 50 or greater.

2. The production is colorless or straw colored but never the green or black colors typical of crude oils.

3. The gas-oil ratio of the reservoir fluid at the stock tank is usually greater than 5000 cu ft per barrel.

In the range of temperature and pressure at which these gas-condensate systems occur the phenomenon of retrograde condensation usually takes place.

The properties of the gas-condensate system that are of interest to the reservoir engineer are: Dew-point pressure of the system at the reservoir temperature, the effect of temperature and pressure on the quantity and composition of the liquid produced by both normal and retrograde condensation and the compressibility factor of the reservoir fluid at both constant composition and for the varying composition that occurs upon pressure depletion.

Various types of apparatus have been described in the literature for use in studying gas-condensate systems.[2, 11, 8, 1, 4, 3, 10, 9] In designing the apparatus described here an attempt is made to include the best features of the designs previously published in addition to incorporating several new features.

The apparatus was designed to make measurements of pressure, temperature, and the volumes of each and all coexisting phases, both liquid and gas. The above measurements plus visual observation of the fluid in the cell make possible the determination of the dew-point pressure, the bubble point pressure and the critical temperature and pressure of the system under study.

The central units of the apparatus are two "windowed" steel equilibrium cells each contained in a controlled temperature air bath and each connected with flexible steel tubing to another steel cell of comparable volume in a U-tube arrangement. The windows in the equilibrium cells permit visual observation of the contents. Each cell connected to a windowed equilibrium cell contains a device for accurately measuring the volume of the mercury contained in it. These cells will be referred to henceforth as "mercury volume measuring" cells or "MVM" cells. Supplementary equipment is provided to measure the pressure in the equilibrium cells, the volumes of hydrocarbon material charged to them and their temperatures. There is also included a motor-driven piston pump to supply a steady quantity of oil at high pressures.

A simplified diagram of the apparatus is shown in Fig. 1. The smaller of the two equilibrium cells 1, designated the "PVT cell" has a capacity of approximately 750 cc. The PVT cell is connected by flexible steel tubing to its MVM cell 3, which contains a device for measuring the volume of mercury it contains. Visual observations are made through the windows 4. The air bath 5 is mounted on trunnions 6 in such a manner that the cell and bath may be rocked as a unit. Suitable thermostatic controls are provided for the electric heaters in the air bath to maintain the air temperature constant. The air is circulated rapidly with a motor-driven fan mounted in the bath.

This cell was designed for ease and rapidity of operation. The effective volume is varied by varying the volume of mercury contained in it from the MVM cell. The windows are situated in such a manner that the volumes of all phases in the cell may be determined by measuring the differences in the angle of tilt necessary to place the various interfaces at the reference point on the windows in the manner explained by Eilerts[8] and illustrated by Fig. 2. The method is very rapid and convenient. The precision of this method of volume measurement is approximately ± 2 cubic centimeters.

The PVT cell was not provided with convenient facilities for sampling the phases. Samples can be taken, however, by placing the cell in a vertical position and removing all the vapor phase at constant pressure following which any part of the liquid phase may be taken as sample.

The larger of the two equilibrium cells 2 is designated as the "piston cell" and has a volume of approximately 2700 cc. It was designed to allow certain operations impractical with the PVT cell. The piston cell is

*Phillips Petroleum Company

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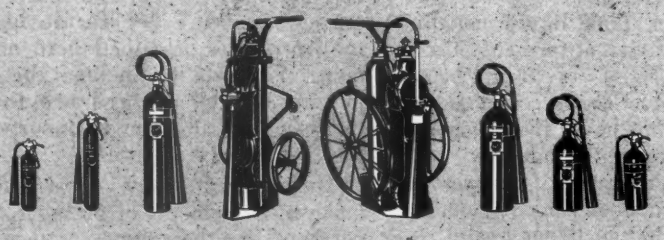

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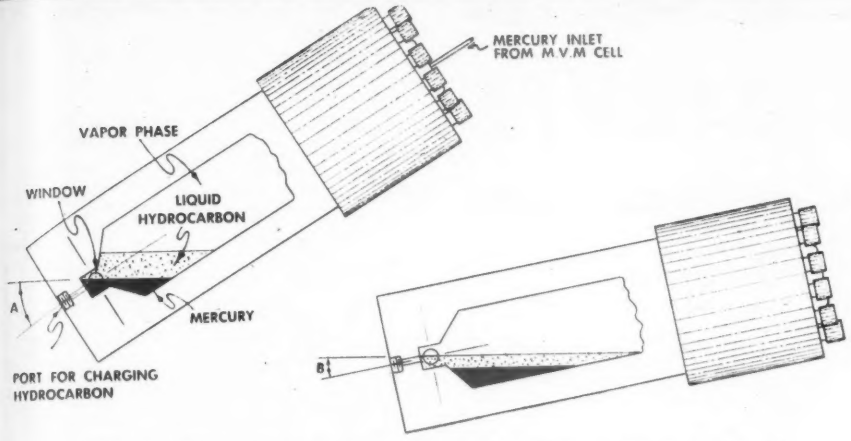


FIG. 2. Phase volume measurement with PVT equilibrium cell.

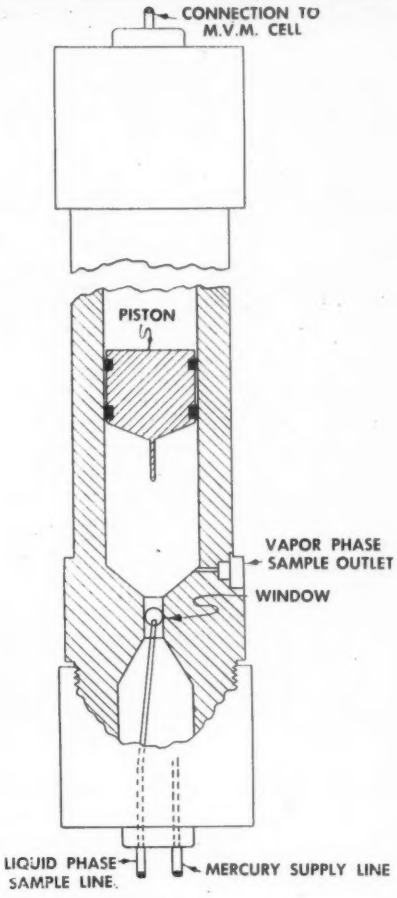


FIG. 3. Piston cell.

mounted in a controlled temperature electrically heated bath 7 mounted on trunnions 8 to allow the cell and bath to be rocked and thus equilibrate the hydrocarbon phases in the cell. Observation of the contents is made through windows 9. The air in the bath is circulated rapidly with a motor-driven fan mounted inside the bath. The effective volume of the cell is varied by changing the position of a freely floating piston by pressuring oil into or out of the companion MVM cell 10. Cell 10 with its mercury level indicator serves to locate the position of the piston in the piston cell and thereby fix the effective volume of the cell above the level of the windows. The effective volume of the cell below the windows is varied by changing the quantity of mercury in reservoir 11 with volumetric pump 19. This arrangement is also used to measure the volume of liquid hydrocarbon phase by placing the cell in a vertical position and observing the difference in volume readings when the gas-liquid interface is centered on the windows and when the liquid hydrocarbon-mercury interface is centered on the windows.

Tests were made using isooctane at room temperature to determine liquid "hang-up" and the drainage time required to reduce the "hang-up" to an unimportant amount. It was found that a drainage time of 2 hours reduced the "hang-up" to less than 0.2 cubic centimeter.

The essential features of the piston cell are shown in Fig. 3. The interior of the cell consists of three sections. The upper section having a capacity of about 2500 cc is normally the space occupied by the gas phase. The lower section having a capacity of about 140 cc is normally occupied by liquid hydrocarbons and controlled volumes of mercury. The small bore section connecting the upper and lower sections contains the glass window assemblies. All interior surfaces are polished to reduce the volume of liquid "hold-up" to a minimum.

Provisions were made to allow either gas or liquid phase samples to be taken at will. The tube that enters at the base and terminates at the level of the windows is used to withdraw liquid samples. This arrangement allows practically complete recovery of all liquid in the cell by placing the liquid hydrocarbon-mercury interface just below the level of the tube opening. Gas samples are removed through a tube in the side of the cell just above the windows. During removal of a gas phase the pressure can be maintained constant by forcing the piston down at the proper rate.

The free-piston type pressure measuring instrument 16 is connected into the oil-filled manifold. Several bourdon-tube pressure gages are situated at various points in the system for convenience. These gages are used only to indicate pressure. Piston gage 16 is used for all measurements where accuracy is required.

Oil at high pressure and at controlled rates from 60 to 250 cc a minute is supplied by pump 13 powered by variable speed motor.

Gas samples are charged to either of the two equilibrium cells from cell 14. This cell, of 2500 cc capacity is mounted in an oil bath whose temperature is thermostatically controlled. The cell is connected by flexible steel tubing to MVM cell 15, which is of similar capacity and is identical to cell 10. Cell 15 also contains the device that provides for measuring the volume of gas contained in cell 14.

All three MVM cells 3, 10, and 15 are placed in a common water filled thermostatically controlled bath and are serviced with high pressure water-white mineral oil from pump 13.

Liquid sample bomb 18 is attached to cell 17 with flexible steel tubing and a metered quantity of liquid sample can be charged into an equilibrium cell by mercury displaced from cell 17 with oil from pump 12. Cell 17 was provided with two electrical contacts to indicate the extremes in mercury level. Pump 12 is a calibrated, hand operated piston-type pump of 250 cc capacity, which will measure volume changes with a precision of ± 0.01 cc.

Pressure Measurement. A free-piston type gage manufactured by the American Instrument Company was used to measure all pressures. The mean diameter of the piston was measured by the Bureau of Standards, which also adjusted the mass of each weight used with the piston gage. The correction to the gage constant for the crevice between the piston and cylinder was determined using the method of Meyers.[5] The pressures measured by the gage were corrected for the difference in height between the mercury in the equilibrium cells and in the MVM cells. It is considered that the pressures measured with the piston gage are correct to ± 2 psi at any pressure within its range. Its sensitivity is such that a pressure change of 0.2 pound per square inch can be detected.

(To be continued)

LAUGH with BARNEY

The operatic tenor was famous, not only for his wonderful voice but also for the amount of alcohol he consumed each and every day of his life.

On this particular night he was not only in good voice but in an extremely gay mood, generated by the number of drinks he had imbided previously to his concert.

After one particularly well-rendered aria, he gathered himself together for the next effort and burped loudly. The pianist immediately sprung to his feet and rushed to the footlights.

"Fod God's sake," he shouted, "Don't anybody strike a match."

* * *

Did you hear about the man who swallowed a quart of shellac? He had a fine finish.

* * *

Imagine the newsboy's embarrassment when he opened the wrong door in the depot waiting room and yelled, "Extra Paper!"

* * *

The Life of the Party was entertaining the guests with a story about the time he attended a nudist dinner party.

"When I got there," he said, "the butler opened the door."

"How did you know it was the butler?" interrupted a listener.

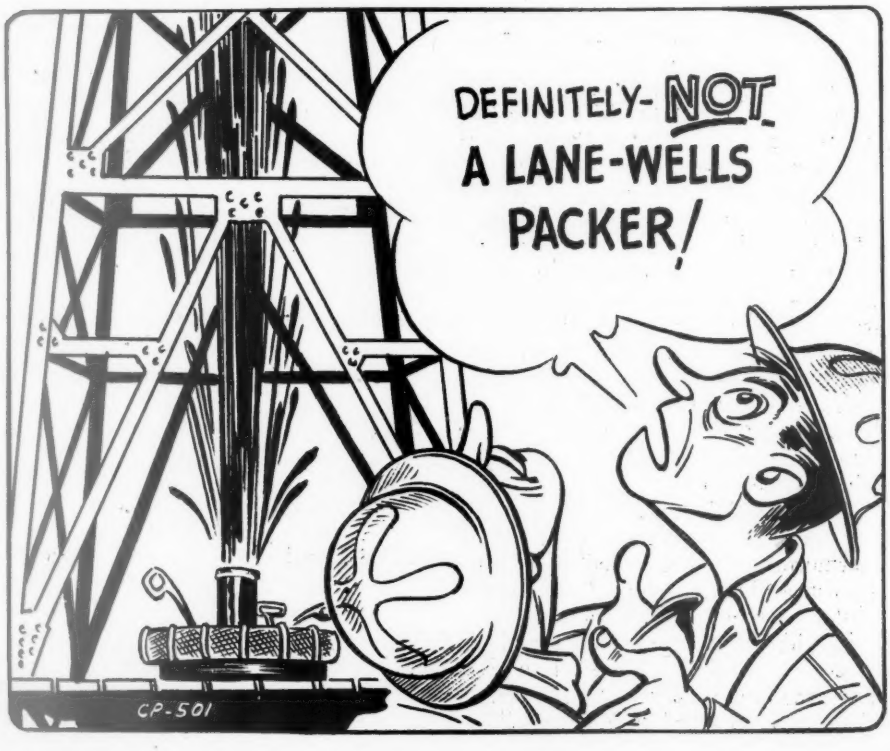
"Well," he said, "I knew it wasn't the maid."

We see it every morning
It happens every day
The double file of lovely girls
Meander on their way.
They march around the corner
Right by the flight of stairs
Where the powder room awaits them
And they always go in pairs.
Perhaps the trip is long and rough
Or the stairs are dark and lonely
But two by two they always go
To the room marked "*Ladies Only*."
The supervisor tears her hair
The boss is torn with grief
The day's production goes to hell
While the girls go on "Relief."
At three o'clock each afternoon
The parade begins once more
What goes on in that little room
That cannot wait 'til four?
The only solution I can find
That is fair to every man
Is to move the whole damn office
Into the Ladies Can!

Anonymous

* * *

The patient was recovering from pneumonia. He repeatedly asked for food and finally the nurse served him a spoonful of rice. A few minutes later the patient called her and said: "Now I want to read a little. Bring me a postage stamp."



"I don't know who I am. I was left on a doorstep."

"Maybe you're a milk bottle."

* * *

Funeral services were being conducted for a woman who had been thoroughly disliked in her rural community. With a violent explosive disposition she henpecked her husband, drove her children mercilessly and quarreled with her neighbors. Even the animals on her place wore a hunted look.

The day was sultry and as the service was ended the storm broke furiously. There was a blinding flash followed by a terrific clap of thunder.

"Waal, she's GOT there!" a mourner said.

* * *

"What happens when a body is immersed in water?"

"The phone rings."

* * *

"I want you to know, my dear, you're the first girl I ever made love to," he said as he shifted the gears with his feet.

* * *

The Sunday school teacher had just finished picturing the beauties of heaven. "Now," she said, "all the children who want to go to heaven put up their hands."

Only one child—a small boy—failed to respond with an upthrust hand.

"Why aren't you ready to go to heaven?" the teacher asked.

"Well," the little boy said, the sign of a struggle on his face: "I've got two rabbit traps set."

* * *

Do not be discouraged son; brace up, tut-tut-tut;
Remember that the giant oak was also once a nut.

* * *

Moe and Joe were fishing in Florida waters for the first time. Suddenly Joe felt a jerk on his line. "Moe," he said, "I got me a haddock!"

"Vel," said Moe, "vy don't you take an aspirin?"

* * *

A fool and his money are invited places.

* * *

A young man was talking to a psychiatrist, "Doc, my wife is convinced she's a chicken."

"How long has this been going on?" asked the doctor.

'For over a year," was the answer.

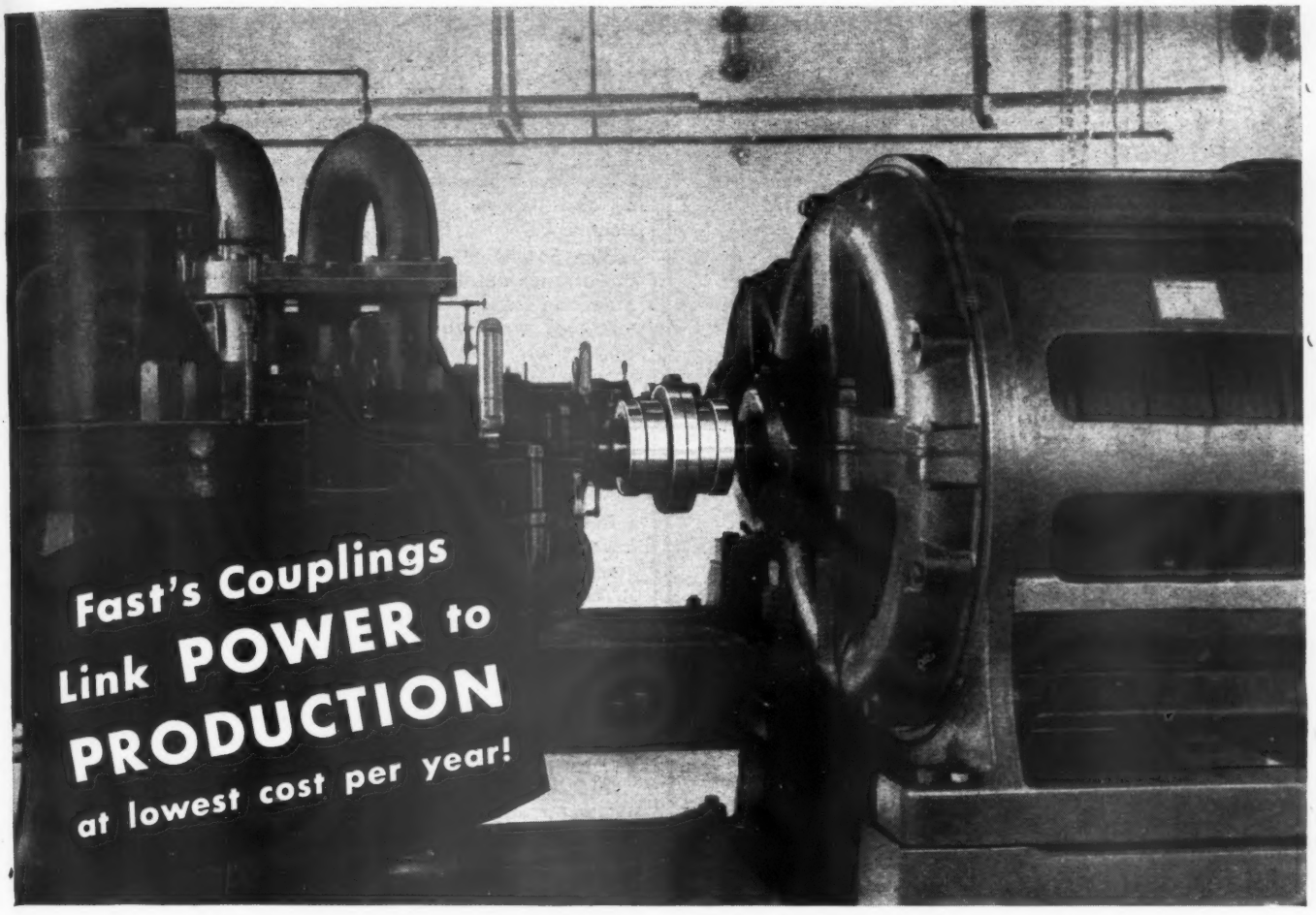
"For heaven's sakes, why did you wait till now to tell me?"

"Well, you see, doc, we needed the eggs."

* * *

"I just got out of prison this morning," a traveler told a man on the train. "It's going to be tough, facing old friends."

"I can sympathize with you," commiserated the other. "I'm just getting home from Congress."



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Couplings

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BOOKS

▸ **The Mines Magazine,** *Annual Petroleum Number. Published by the Colorado School of Mines Alumni Association, 734 Cooper Building, Denver, Colorado. Price, $2.50. Pages, 172.*

The petroleum edition of the MINES magazine, covering exploration and development of oilfields throughout the Rocky Mountain district and throughout the petroleum industry, contains 132 maps, illustrations, and tables. Articles of interest concern the Julesburg Basin, the Rockies, Utah, oil well spacing, Williston Basin, sulfur from natural gas, latest developments in secondary recovery, and a review of the oil and gas industry highlights in Canada for 1950-1951. The magazine gives a picture of the more up-to-date developments holding the interest of the industry at the present time.

▸ **Petroleum Conservation,** *edited by Stuart E. Buckley. Published by American Institute of Mining and Metallurgical Engineers, Trinity Universal Building, Dallas 1, Texas. Price, $6. AIME, $3. Pages, 324.*

Of interest to the petroleum executive, lawyer, engineer, and geologist, this book traces the behavior of oil and gas in their natural underground reservoirs. The causes of waste are brought out as well as the conflicts that hinder the conservation of petroleum. Written by a group of engineers whose contributions are welded together into one continuous story, the book will prove an invaluable reference as well as a fascinating insight into the technical workings of efficient recovery. Elements of conservation, the petroleum reservoir, characteristics of reservoir fluids, fundamentals of oil recovery, secondary recovery, pressure maintenance, state regulations, and cooperative development, are some of the subjects covered.

▸ **The Handbook of Measurement and Control,** *edited by M. F. Behar. Published by Instruments Publishing Company, 921 Ridge Avenue, Pittsburgh 12, Pennsylvania. Price $3. Pages, 278.*

The "Handbook" is designed to bring classifications, operating factors, and typical applications of instruments to users, manufacturers, and students. The term "instruments" includes all indicating, recording, integrating, controlling, and computing devices used in measurement, inspection, testing and control applications. Laboratory, scientific, engineering, and industrial instruments are included. Coverage precludes detailed discussion of physical fundamentals of every type instrument. All basic methods and mechanisms are brought out, including pneumatic, hydraulic, electric, and electronic instruments. Emphasis is on practical factors, and terminology is considered carefully.

▸ **Gurley Manual of Surveying Instruments,** *published by W. and L. E. Gurley, Troy, New York. Price, $1. Pages, 150.*

This new, pocket-sized edition, contains much information for the engineer. Included is a complete explanation of the theory and application of the Beaman stadia Arc, types of reticles and reticle patterns for particular purposes, level vial construction and use, as well as assorted tables of logarithmic and natural functions, distance and elevation stadia readings. Instructions on the use of Gurley instruments are interwoven with a discussion of good surveying habits.

▸ **Analysis of Canadian Crude Oils,** *by H. McD. Chantler, P. B. Seely, and F. E. Goodspeed. Published by Canada Department of Mines and Technical Surveys. Price, 50 cents. Pages, 90.*

This report presents the analysis of 88 samples of crude oils received at the Fuel Research Laboratories from 1931-50. These samples do not represent all crude oil sources in Canada. Analyses of three crude oils from the U. S. are included for comparison. Each analysis consists of: distillation by the Hempel method, specific gravity, sulfur content, water content, color, cloud and pour points, viscosity, and carbon residue.

Rocky Mountain Petroleum Directory, *compiled by the Editors of the Rocky Mountain Oil Reporter. Price, $1.50. Pages, 128. Petroleum Publishers, Inc., 724 Cooper Building, Denver, Colorado.*

The operators, suppliers, drilling contractors, refineries, geologists, petroleum engineers, brokers, pipe line companies, and associations which operate in that district of the United States known as the Rocky Mountain area, are listed in this little booklet. States regarded as Rocky Mountain include: Arizona, Colorado, Montana, Nebraska, Nevada, New Mexico, North and South Dakota, Utah, and Wyoming. The listings are alphabetical, giving the full name and address, and, for some, a list of properties owned.

Boiler Feed Water Treatment, *by F. J. Matthews. Published by Chemical Publishing Co., Inc., 26 Court Street, Brooklyn, New York. Price, $4.50. Pages, 207.*

In five parts and an appendix which discusses reagents, conversion tables, etc., this work is designed primarily for the guidance of the water chemist or the steam generation employe who needs first-hand practical details to guide his operations. Details of scale formation and the application of methods such as zeolite softening, lime-base exchange, Phosphate treatment, etc., are discussed in good detail but not voluminously. Cooling water systems are discussed also including the removal of scale and deposits, grease and oil, etc.

Cause and cure of foaming and priming, of corrosion are presented; several different blowdown hoopup systems are shown, along with analytical methods.

Dollar Savings Through Standards, *published by American Standards Association, Inc., 70 East 45th Street, New York 17, N. Y. Price, $1. Pages, 32.*

The value of standardization in the petroleum industry is emphasized in the first comprehensive survey made of the savings effected in American industry by the use of standards. It consists of 140 case studies covering 81 industries and industrial products. Six of the case studies are in the petroleum field. As long ago as 1934, the API issued an analysis showing the savings made possible for the industry through standardization. The savings amounted to over $14 million. Even in an industry which prides itself on the intensity of the spirit of competition that imbues all companies, standard equipment has always benefited large and small organizations.

Industrial Studies of Pennsylvania Slate Production, *by C. W. Stickler, W. F. Mullen, A. Wayne Bitner. Published by School of Mineral Industries, State College, Pennsylvania. Price, $2. Pages, 43.*

This bulletin is a report of studies devoted to the economic factors of milling and quarrying operations with emphasis on the solution of production ills in the slate industry. The mechanics of the industry were analyzed by methods analysis and time study in an effort to determine the bottlenecks of production flow. Recommendations are included covering some proposed solutions to high-cost production difficulties and some possible design and applications of new machine techniques.

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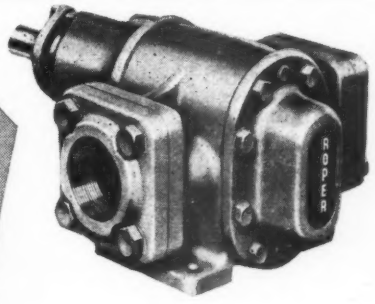

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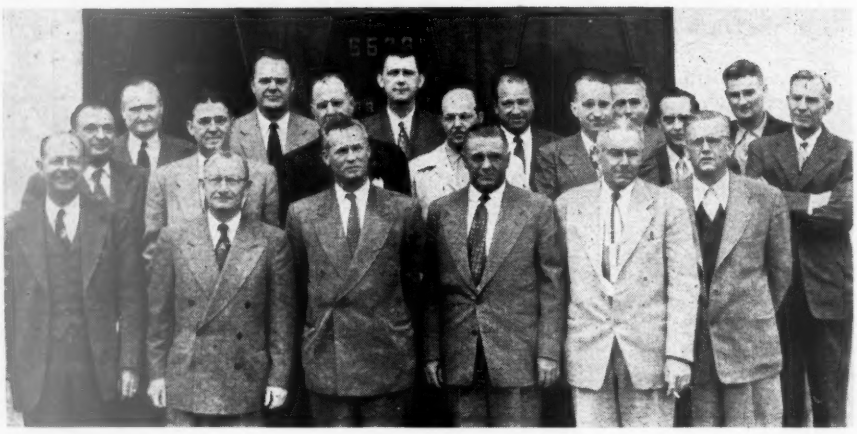
OIL AND GAS TRADE NEWS



Grove executives met recently and held their first annual sales meeting. Twenty sales representatives were among those who attended.

Lunkenheimer Observes Ninetieth Anniversary

Observance of The Lunkenheimer Company's 90th anniversary keynoted the firm's 1952 sales conference in Cincinnati, Ohio, recently. Lunkenheimer personnel from all over the U. S. and many foreign countries participated in the annual conference, with headquarters in the Netherland Plaza Hotel.

"The year 1952 marks the completion of 90 years of consistent growth and progress at Lunkenheimer," Paul M. Arnall, president and general manager, stated. "Founded in 1862, in the depths of a turbulent war-time period, Lunkenheimer has developed into one of the world's foremost manufacturers of valves and engineering devices."

Cleco Names Distributors

The Cleco division of the Reed Roller Bit Company, Houston, Texas, has announced the appointment of George W. Cassady Company, Sylvan Dell Road, Williamsport, Pennsylvania; Davenport Engineering Company, 415 West Third Street, Davenport, Iowa; and Monogram Air & Power Equipment, Inc., 125 Olive St., New Haven, Connecticut, as distributors for Cleco products in their areas.

Hercules Plant to Make Phenol, Cresol, and Acetone

Plans for erection of an $8,000,000 plant for the production of phenol, para-cresol, and acetone by a new process were announced by Hercules Powder Company.

Capacity of the new plant, which is scheduled for completion in 1953, has not been announced. It is understood, however, that production of para-cresol and cymene alcohols will be sufficient to care for expected increasing demands of industry; production of phenol and acetone will also be appreciable. The processes are similar enough to permit much of the equipment to be used interchangeably; thus, capacity of each product can be increased if desired, while reducing the output of the other products in the processing cycle. The new plant is to be situated in Wilmington, Delaware.

Technical Committee Meets

The Technical Committee of the Diamond Core Drill Manufacturers Association held a meeting in Enid, Oklahoma, at the plant of the George E. Failing Supply Company, recently. It was preliminary to the national meeting of the association, held in New York City in February.

Attending the meeting were: Front row, George C. Winther, R. F. Norrick, and Munsey Waters. Back row, I. F. Schenewerk, Jr., Adrian Ross, M. L. Tucker, and Raymond Jones.

Grove Holds Annual Meeting

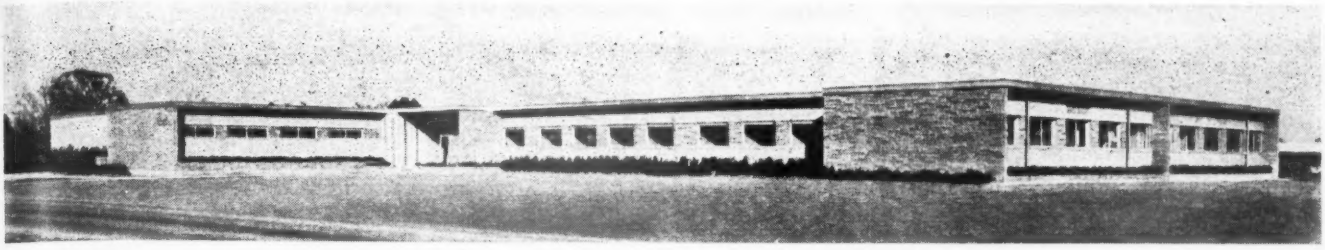
The Emeryville, California, plant of the Grove Regulator Company was the scene of the firm's annual sales meeting, held recently. Joining with Grove executives at the comprehensive 3-day sessions were 20 field sales representatives from the firm's district offices in New York, Louisiana, Oklahoma, Texas, and Southern California.

Among those attending the sessions were: (front row) E. H. McMenemy, office manager, Houston; C. W. Garrison, office manager, New York; J. A. Records, district engineer, Lafayette, Louisiana; J. D. Hicks, Corpus Christi; L. D. West and George Doty, Emeryville. Second row, A. V. Bryant, chief engineer, Emeryville; L. R. Van Arsdale, Tulsa, Oklahoma; L. S. Robb, Dallas, Texas; W. H. Orth, Los Angeles; K. F. McIntire, H. A. Ward and M. H. Grove, Emeryville; (back row) C. B. Truitt, Southwestern division sales manager, Houston, Texas; W. G. Folsom, Odessa, J. A. Mattson, New York; J. W. Collins, E. E. Mann and H. Wolpman, Emeryville.

U. S. Rubber Sets Up New International Division

United States Rubber Company has announced that a new international division has been created known as United States Rubber International, division of United States Rubber Company. The present foreign subsidiary, United States Rubber Export Company, Ltd., will be dissolved. L. C. Boos, president of the export company, has been elected a vice president of United States Rubber Company, and will become general manager of the international division.

Meeting in Enid, Oklahoma, recently was the Technical Committee of the Diamond Core Drill Manufacturers Association.



Lummus Company's new office building recently completed at 2707 Weslayan Road, Houston. Completion of the new building gave the Houston branch a completely self-contained and integrated division according to C. A. Barrere, Lummus vice president.

Lummus Gets New Offices For Houston Branch

The Lummus Company moved its Houston, Texas branch organization into a new office building at 2707 Weslayan Road, Houston.

C. A. Barrere, vice president, who is in charge of the Houston office, evaluated the expansion in terms of local impact. "Today, for the first time," he stated, "our Houston operations are completely self-contained and integrated. The branch now houses a heavy concentration of design, engineering, and construction functions, plus the various service departments to support them—a complete team for handling a project from start to finish."

Cement Plant in Operation

The Lone Star Cement Company has announced the first shipment of cement from its newly completed plant at Maryneal, in Nolan County, Texas. The new mill has a capacity of approximately 4200 bbl of Lone Star cements a day.

Situated on the Santa Fe lines near the town of Maryneal, the new plant is comprised of 12 durable concrete structures that house the various manufacturing and service operations.

Sales Force Reorganized

The Owens-Illinois Glass Company's Kaylo division has announced a new organization of its insulation sales force establishing regional supervisors and branch managers with broad responsibilities.

T. F. Scars

L. F. Scott

R. L. Long

The plan provides for three regional supervisors who will direct insulation sales in their areas. Under them are five new branch managers handling Kaylo products.

Those promoted to regional sales supervisors are Thomas F. Sears of Bowling Green, Ohio, who will direct insulation sales in southwestern United States from offices in Houston, Texas; Lewis F. Scott, who will cover the midwest from Chicago, Illinois; and Robert L. Long of Maumee, Ohio, who will cover the east from Toledo.

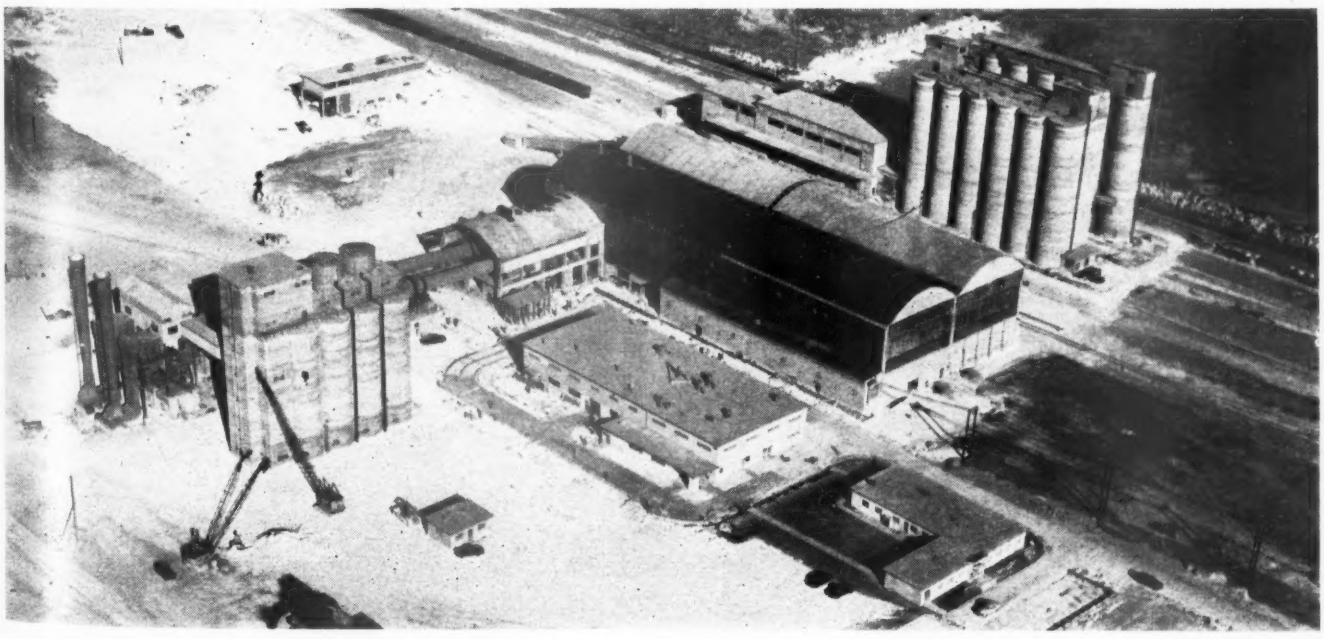
Those promoted to branch managers are Arthur B. Pike, former sales engineer in Boston who will head the office there; Carl Ramien, sales engineer, who will head the Philadelphia office, which will be expanded to include the Washington, D. C. territory; Robert L. Major, sales engineer to manager in Pittsburgh; Ike Keith, sales engineer to manager in St. Louis; and James D. Hailey, sales engineer to manager in Cleveland.

DeLaval Appoints Agents

The De Laval Steam Turbine Company has recently announced the appointment of Vancouver Engineering Works, Ltd., as its exclusive representative in the Province of British Columbia, Canada.

Vancouver Engineering Works, Ltd., has been established in the Province of British Columbia for the past 22 years. They will handle products of De Laval Steam Turbine Company, including centrifugal pumps, blowers, compressors, and steam turbines.

The first shipment of cement to come from its newest plant has been announced by Lone Star Cement Corporation. The new plant is situated in Nolan County, Texas, and has a capacity of approximately 4200 bbl of cement a day, the company announced.



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Sievers Buys Warehouse

The Sievers Company, Long Beach, California, announces its purchase of a warehouse at 207 N. Amburgey St. in Odessa, Texas. This large warehouse has been purchased for the purpose of expediting the growing business in Kingseal and Queenseal, additives to prevent and eliminate lost circulation in oil well drilling, recently put on the market by E. S. Sievers.

Allis-Chalmers Plans New Factory Branch

Twelve acres of land at Knowland Road and 35th Street, Independence, Missouri, were purchased recently by the tractor division of Allis-Chalmers Manufacturing Company. The company reports plans for immediate construction of a new and modern factory branch to serve agricultural and industrial dealers in eastern Kansas and western Missouri.

According to Willis G. Scholl, vice president and general sales manager of the tractor division, the facilities will replace the Kansas City branch, which has been located at 1224 West 12th Street since 1931.

B&W Names Agent

Appointment is announced by B and W Inc., of Hub Supply Company, 211 Airport Drive, Shreveport, Louisiana, as sales and service representatives for B and W products. They will serve the East Texas, North Louisiana and Arkansas areas.

Hub Supply Company will maintain warehouse stocks of B and W Latch-On centralizers with Kon-Kave bows, Multi-Flex scratchers, Hinged Nu-Coil scratchers, Rotating scratchers and wall cleaning guides. They will also provide field service to assist in the installation of the equipment on the casing and during the entire cementing operation.

Aeroquip Ends Agreement With Aeroquip Sales

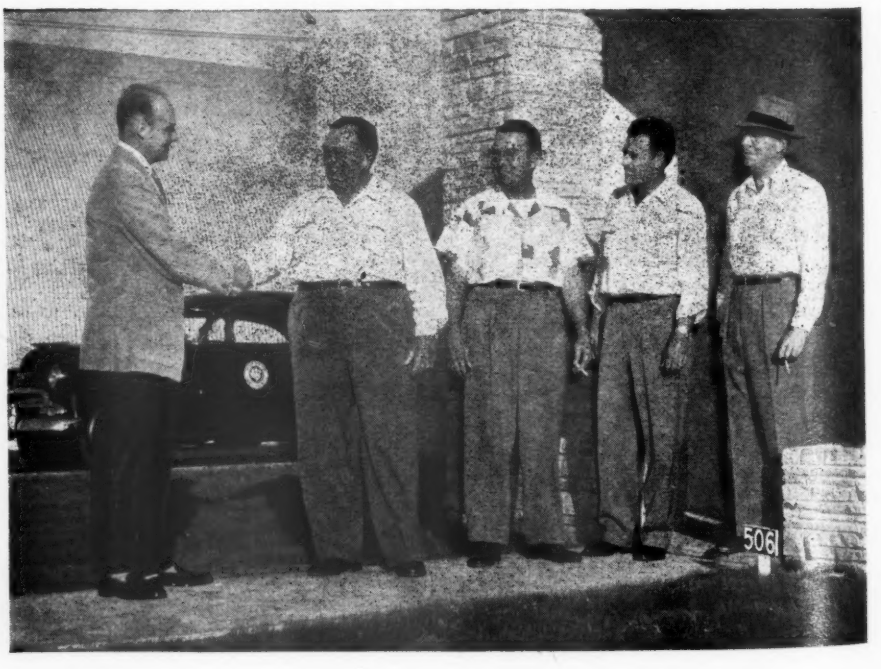
Aeroquip Corporation, Jackson, Michigan has terminated arrangements with its South-Southwest United States distributor, Aeroquip Sales and Engineering, Inc., Fort Worth, Texas. Beginning February 1, Aeroquip's customers throughout the new territory covering 14 states are being contacted directly by specially trained sales engineers operating from Aeroquip Corporation nad its subsidiary, Areo-Coupling Corporation, Burbank, California.

Equipment Manufacturers Occupy New Warehouse

Cameron Iron Works, Baash-Ross Tool, Hughes Tool, and Arnold Pipe and Supply Company opened up for business recently in their new offices and warehouse at Corpus Christi, Texas. Walter Kalteyer, equipment engineer for Humble Oil and Refining Company at Corpus Christi, is being welcomed by the equipment representatives.

Left to right: Kalteyer, Clarence Griffith, special representative for Hughes Tool; H. Z. Brown, sales representative for Baash-Ross Tool; F. H. Isaacs, South Texas division manager for Cameron Iron, and Dick Arnold, head of Arnold Pipe and Supply and owner of the new warehouse.

Cameron-Iron Works, Baash-Ross Tool, Hughes Tool, and Arnold Pipe and Supply Company opened their new offices and warehouse in Corpus Christi, Texas, recently. Representatves of the four companies are shown in photo below.



Sterling Plant Underway

Sterling Electric Motors, Inc., has begun production in its new $2,000,000 plant on an 11-acre site in Van Wert, Ohio. The new Sterling Van Wert factory is one of the most modern manufacturing plants for the production of gears, splines, and gear boxes.

E. O. Danielson, Sterling's general factory manager, will be in charge of the new Van Wert plant, as well as Sterling's New York and Los Angeles plants. B. L. Peak is being transferred from Sterling's Los Angeles plant to serve as superintendent of Sterling's new Van Wert plant. E. K. Johnston, production superintendent of the Los Angeles plant, becomes general superintendent of Sterling's Los Angeles manufacturing facilities.

Pioneer Rubber Enlarges

Pioneer Rubber Mills has expanded the operations of its Dallas, Texas, regional headquarters by leasing a warehouse and office space at 1205 Levee Street. Telephone number is STerling 4684. Previous to this move, only office space was maintained in this area. O. D. Upton, regional manager, reports that he already has in stock a large inventory of representative Pioneer products, including industrial belting and hose, fire hose, packing, and specialty items.

O. D. Upton

Ampco Names Agent

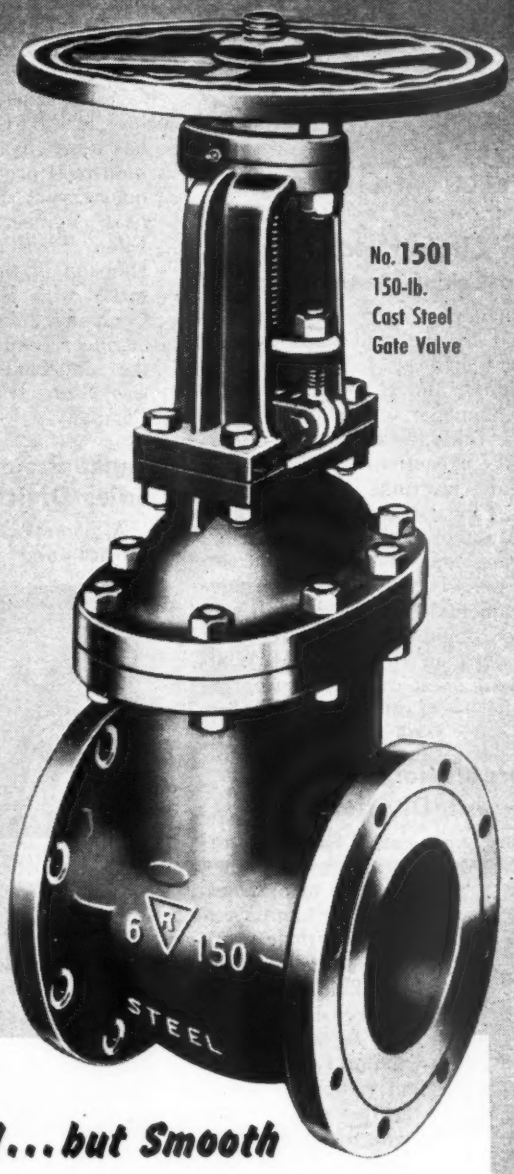
Ampco Metal, Inc., Milwaukee, Wisconsin, recently announced the appointment of Upton, Bradeen, and James Ltd., of Canada as an exclusive distributor of Ampco weld resistance welding tips, dies, holders, rods, bushings, wheels, etc. The main office of Upton, Bradeen and James Ltd., is in Toronto, Ontario with branch offices in Moncton, New Brunswick; Montreal, Quebec; Ottawa, Hamilton, and Windsor in Ontario; Winnipeg, Manitoba; and Vancouver, British Columbia.

KLM Orders Convairs

KLM Royal Dutch Airlines will put new C-340 Convair-liners in service on their West Indies network in 1953-54, it was revealed with the announcement that six of the new air transports have been ordered from Consolidated Vultee Aircraft Corporation, San Diego, California.

The Convairliner 340 is America's largest and newest twin-engine transport with a seating capacity of 44. The 340's ordered by KLM will be 4 ft longer than the present 240—having a wing span of 105 ft and 8 in. and a gross weight of 45,000 lb, thereby providing for heavier payloads particularly on the shorter West Indies stretches.

an ACCO product



TOUGH... but Smooth

● Electric furnace steel is used in the manufacture of RP&C Cast Steel Valves with all parts of equal strength, they are tough. Bodies resist distortion. One-piece yoke is rigid, provides permanent alignment. Gland packing stays tight at high pressures and temperatures. Requires little servicing. Internal design permits smooth flow and positive shut-off.

You'll save money with R-P&C Cast Steel Gate Valves. See your R-P&C distributor or write the nearest R-P&C district office for information.

ACCO

TRADE MARK

R-P&C VALVE DIVISION
AMERICAN CHAIN & CABLE

Reading, Pa., Atlanta, Baltimore, Boston, Chicago, Denver, Detroit, Houston, New York, Philadelphia, Pittsburgh, San Francisco, Bridgeport, Conn.

R-P&C valves

H. W. Beder

J. W. Anderson

Whitney Chain Holds Coast-to-Coast Meetings

The urgency of sales problems was exemplified by the rapid fire tour recently completed by J. W. Anderson, vice president, and H. W. Beder, general sales manager, of Whitney Chain Company. Taking exactly one week, the Whitney executives conducted "on-the-job" sales meetings in San Francisco, Dallas, Chicago, Atlanta, and Philadelphia. Main objective of these meetings was to step up customer service during a period of material shortages and governmental controls through supplying the company's sales force with complete data on the effect of Whitney's current plant expansion program and use of its new sales "service" plan.

Ken Corporation Sets Up New Export Division

Continued expansion of Ken Corporation has caused the formation of another division of the company to handle exports of their products, Ken-Oil drilling fluid and Ken-Pak casing protector. Known as Ken Export Corporation, this branch will serve various countries of the Western Hemisphere. Officers are Earl V. Tavan, Jr., president; Neal B. Thompson, vice-president and Keith B. Bright, secretary-treasurer. Petroleum Industries C. A. will act as distributor of Ken products in Venezuela and additional distributors will be appointed to handle the growing sales.

E. V. Tavan, Jr.

Thompson Products Expands Its Industrial Services

In a move designed to expand and increase the scope of its service to general industrial plants, the oil industry, railroads, municipal power plants, and the chemical industry, the West Coast plant of Thompson Products, Inc., Bell, California has announced formation of its industrial products division, with branch headquarters in Dallas, Texas. This new division of the firm replaces the former Mid-Continent division, and will act as the Dallas branch of the West Coast plant.

In line with this broader industrial coverage, personnel changes have also been announced. James D. Creek, formerly Mid-Continent division manager, has been named manager of the new industrial products division, and will be in charge of the wider activities of this new department.

A. S. King, formerly field engineer in the Mid-Continent for Thompson, has been advanced to district manager, industrial products division, with headquarters at Dallas, Texas. Two new field engineers have also been added. Elton T. Blanton will work out of Houston in that capacity. He was formerly with Humble Oil and Refining Company. John T. Ross will act as field engineer from Lubbock, Texas, serving the industrial field in that area. Ross was formerly with Coastal Transport Company.

Lunkenheimer Names New Sales Division Heads

A general reorganization of sales territories and executive appointments,

C. W. Burrage

H. H. Layritz

M. W. Pauly

aimed at closer coordination of sales activities throughout the United States, has been announced by Harry A. Burdorf, vice-president—sales of The Lunkenheimer Company. The reorganization was necessitated by the rapid development and expansion of Lunkenheimer operations. The United States will be divided into three Lunkenheimer sales areas—an eastern division, under Melvin W. Pauly, sales manager; central division, headed by Harold H. Layritz, sales manager; and western division, directed by Charles W. Burrage, sales manager.

R. J. Sardieck, with headquarters in Philadelphia, has been appointed district manager in the eastern division. E. R. Tieberman has been named district manager in the central division with headquarters in Dallas. C. B. Rosser, Jr., district manager, will head the western division in Los Angeles.

Anchor Office Opened

Anchor Coupling Company, Inc., Libertyville, Illinois, has announced opening of a new branch office and warehouse at 2100 Irving Boulevard, Dallas, Texas. The warehouse will be completely stocked with all hydraulic hose equipment, Anchor reported.

C. O. Moorhead

H. C. Garlick

LeBus Agents Named

LeBus International Engineers, Ltd., announced the appointment of M-C-M machine works as sales and service representative for LeBus grooving and wire line spooling service in the Oklahoma area.

C. O. Moorhead, general manager for M-C-M, will handle all wire line grooving sales. He has been closely associated with LeBus during the past 4 years. The installation and service of LeBus grooving and wire line spooling systems will be under the supervision of H. C. Garlick, field engineer of M-C-M Machine Works.

Edwards Plant Opens

Allan Edwards Manufacturing Company, Inc., announces the opening of its new plant at 2445 South Jackson in West Tulsa, beginning operations with three men on November 1, 1951, the working force has now grown to six and is expected to climb to 20 men by June 1, 1952.

Offering both engineering and precision manufacturing service, this plant is at present engaged in defense work, but is expected to convert to oil country specialties whenever the emergency is over. Plans for peacetime activities have been made far in advance and these plans call for considerably larger scale activity and expanded plant facilities for which the present plot with its railroad facilities provides.

DeLeval Forms Subsidiary

The De Laval Steam Turbine Company, Trenton, New Jersey, has announced the formation of a subsidiary corporation, the De Laval Turbine Pacific Company. Headquarters for the company will be in the new building at Main and Folsom Streets, San Francisco, California, which was erected by De Laval Steam Turbine Company in 1951. Company officers are: G. W. Smith, Jr., chairman; J. P. Stewart, president, and C. F. Reeves, vice president and general manager.

C. F. Reeves

Reeves will be in direct charge of operations of the company, continuing the duties he has held for many years as West Coast manager of De Laval Steam Turbine Company.

Rocky Mountain division headquarters for Reed Roller Bit Company in Casper, Wyoming.

Workman to Handle Western Advertising

Tom W. Flewharty, advertising-public relations director of the Western Company, Midland, Texas, announces the appointment of Ted Workman Advertising, Dallas, Texas, to handle the advertising and promotional activities of the company. The Western Company, with offices at 111 Midland Tower, Midland, Texas, specializes in engineered acidizing and perforating.

American Meter Opens New Dallas Plant

The annual sales meeting of American Meter Company was held at Dallas, Texas, recently. Representatives of the sales department and key members of the company's manufacturing divisions assembled for a three-day meeting held prior to the formal opening of the company's new Dallas plant.

Donald Holtz, insert, is manager of the new plant. Other members of the company grouped in the reception room are, left to right: William B. Ashby, secretary; T. A. Bracken, Jr., treasurer; A. F. Benson, vice president-engineering; C. B. Dushane, Jr., vice president, sales; W. G. Hamilton, Jr., president; A. McBeath, controller; and vice presidents, A. E. Weingard, production; D. C. Struble, purchasing, and D. C. Wiley, research.

Reed Opens Casper Plant

The Reed Roller Bit Company has opened new headquarters on East Yellowstone Highway at Casper, Wyoming. The Casper office is Rocky Mountain division headquarters for the company, with Ben Hanly, division manager, in charge.

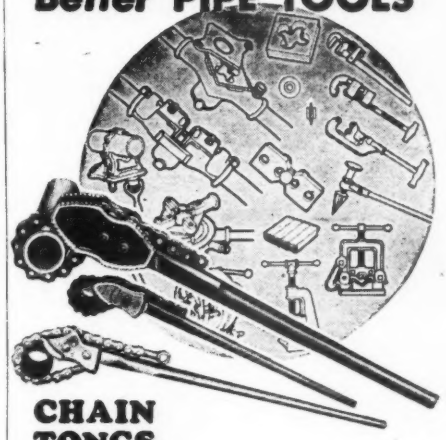
New Corporation Sets Up As Clark Export Branch

The formation of a new corporation, Clark Bros. Pan American, Inc., has been announced. The new organization will act as the export corporation in Mexico and South America for Clark Bros. Co., Inc., Olean, New York, and will sell the engine and compressor products manufactured by that company, exclusively. It will also handle service and warehouse facilities.

In addition to its home office, which will be on North Fifth Street, Olean, New York, and a New York City office in Room 800 of the Chanin Building, offices will be maintained in Mexico City, Mexico and in the following South American cities: Caracas, Venezuela; Buenos Aires, Argentina; Bogota, Colombia; Lima, Peru, and Rio de Janeiro, Brazil. Officers in the new company are: F. W. Laverty, president; J. B. O'Connor, R. E. Reimer, D. K. Hutchcraft, R. R. McCartney, and T. C. Webb, vice presidents.

American Meter representatives in Dallas, Texas for their annual sales meeting.

ARMSTRONG BROS.
Better PIPE TOOLS



CHAIN TONGS

"Reversible," "Standard" and "Ideal" types in all sizes. Jaws are drop forged from special steel, are carefully milled, heat treated, hardened and tested. The *Handles* are forged spring steel. The *Chains* are proof-tested to ⅔ catalog strength (1,200 lb. to 40,000 lb.). "Reversible" Jaws give double jaw life. "Standard" Jaws have extra bearing on the handle and forged-in chain guides. The "Ideal" Tongs have V shaped teeth for a sure grip on irregular shapes—fittings, etc.

Write for Catalog

ARMSTRONG BROS. TOOL CO.
"The Tool Holder People"
5231 W. ARMSTRONG AVENUE • CHICAGO 30, ILL.

MERCOID

THEY ARE USED FOR THE CONTROL OF TEMPERATURE, PRESSURE, LIQUID LEVEL AND MECHANICAL OPERATIONS.
THE MERCURY SWITCH IS A FEATURE IN MERCOID CONTROLS. THE REASON FOR THE MERCURY SWITCH IS THE ADDED SAFETY, BETTER PERFORMANCE AND LONGER CONTROL LIFE—ALL OF WHICH ARE IMPORTANT WHEREVER CONTROLS ARE REQUIRED. WHY CONSIDER LESS WHEN YOU CAN GET SO MUCH MORE.

WRITE FOR COMPLETE CATALOG

THE MERCOID CORPORATION
4201 BELMONT AVE. CHICAGO 41, ILL.

To obtain more information on products advertised see page E-41

TRADE PERSONALS

W. T. Sargeant

R. L. Williams

R. L. Williams has been appointed controller of the Houston, Texas, plant of The National Supply Company. He succeeds **William T. Sargeant,** who retired January 31, after nearly 40 years with the company. Williams, a native of Houston, entered the accounting department of the Houston plant of The National Supply Company in 1945. Sargeant joined the Union Tool Company, now merged with National Supply, in 1912. He was made office manager of the new Houston plant in 1935 and was promoted to plant controller in 1946.

Thomas L. Vance has been assigned to South Chester Tube Company's office at 307 Life of America Building, Fort Worth, Texas. **Ivan M. Fischer** has become associated with the company at 904 Niels Esperson Building, Houston. **Robert E. Wallace, Jr.** has been transferred from the eastern district to the Mid-Continent district, and has opened headquarters in Hutchinson, Kansas.

Louis J. Coppola has been named manager of government sales for the mechanical goods division, United States Rubber Company. He succeeds **George H. Pendleton** who is retiring from the company after 46 years of service. Coppola joined U. S. Rubber in 1925 in the sales department of the company's New York branch. Prior to his present appointment, he was assistant manager of the government sales department. Pendleton joined Peerless Rubber Company, now a part of U. S. Rubber, in 1905.

E. L. "Jack" Henry has joined Crutcher-Rolfs-Cummings to be in charge of the stationary pipe coating and wrapping division. Henry worked on the war emergency pipe line during World War II and has been active in all phases of the pipe line industry, having worked both in a supervisory capacity and as an inspector. During the last year he has been chief inspector for the Trunkline Gas Company.

E. L. Henry

William J. Brinkworth has been named representative, distributor sales, southwestern division, Link-Belt Company, with headquarters at the company's plant in Houston, Texas. Brinkworth has been field manager, oil field distributor sales, and continues in this capacity but will now also supervise sales through the company's many industrial distributors in the Southwestern division. Brinkworth entered Link-Belt employ.

Lester B. Swan, general manager of United Oilwell Service, S. A., in Caracas, Venezuela, has been named assistant manager of Dowell Incorporated. **Tromer Smith,** former Eastern division manager of United, has been named general manager of the South American company. United Oilwell Service is an associate company of Dowell. Smith is a former Dowell engineer, located in Great Bend, Kansas.

L. B. Swan

A graduate of the University of Tulsa, Swan was formerly a district manager for Dowell, Inc., in New Orleans, Louisiana.

Orville R. Brogdon is the new vice president and sales manager of the Benson Tractor Company, Houston, Texas. Prior to his appointment to the vice presidency and a position on the firm's board of directors, Brogdon was sales manager. He has been with the company seven years.

O. R. Brogdon

John Lund has been appointed district manager of Air Reduction Magnolia Company, a division of Air Reduction Company Inc. With headquarters at Shreveport, Louisiana, Lund will have sales responsibility for the Shreveport district, assuming the responsibilities of Heber T. Wadley, deceased. Formerly Lund was assistant manager at Shreveport under Wadley.

G. B. Herbert, Surrey, England, will handle Airetool sales for Airetool Manufacturing Company in the British Isles, where he has been active in the tube cleaning and expanding field for over 25 years. In addition to this new foreign sales agent, Airetool Manufacturing maintains sales representatives in South America, Mexico, and Canada.

G. L. Ratcliffe

George L. Ratcliffe has been elected a vice president of National Lead Company. He has been a member of the board of directors since 1948. Ratcliffe, who was graduated from the Carnegie Institute of Technology as an electrical engineer, joined National Lead in 1929. At that time he was president and general manager of the California Talc Company, one of the predecessor companies to the present Baroid Sales Division. Prior to the organization of California Talc, Ratcliffe saw service with Standard Oil Company of New Jersey, Texas Pacific Coal and Oil Company, and the General Petroleum Corporation.

Ratcliffe has been general manager of the Baroid Sales Division since company operations under that name were begun in 1939.

Frank Crane has been named chief engineer, Martin-Decker Corporation. After working in the drilling department of The Continental Oil Company of California, Crane graduated from the Colorado School of Mines where he majored in petroleum engineering.

C. B. Smythe was elected president of the Power Crane and Shovel Association at the annual meeting in Washington. Smythe is president of the Thew Shovel Company, Lorain, Ohio, manufacturers of "Lorain" power shovels and cranes. The Power Crane and Shovel Association is comprised of 16 manufacturers of power cranes and shovels in the classification known as "commercial sizes."

G. B. Richards has been elected president of OPW Corporation, Cincinnati, Ohio, manufacturers of valves, fittings, and assemblies for handling hazardous liquids. Previous to his association with OPW Corporation as executive vice president in 1949, Richards was general sales manager of the Firth Sterling Carbide and Steel Company of Pittsburgh, and of the Bostitch Company.

G. B. Richards

The practical way to save pipes, tanks, derricks, buildings, pumps, roofs, fences

STOP RUST! with RUST-OLEUM

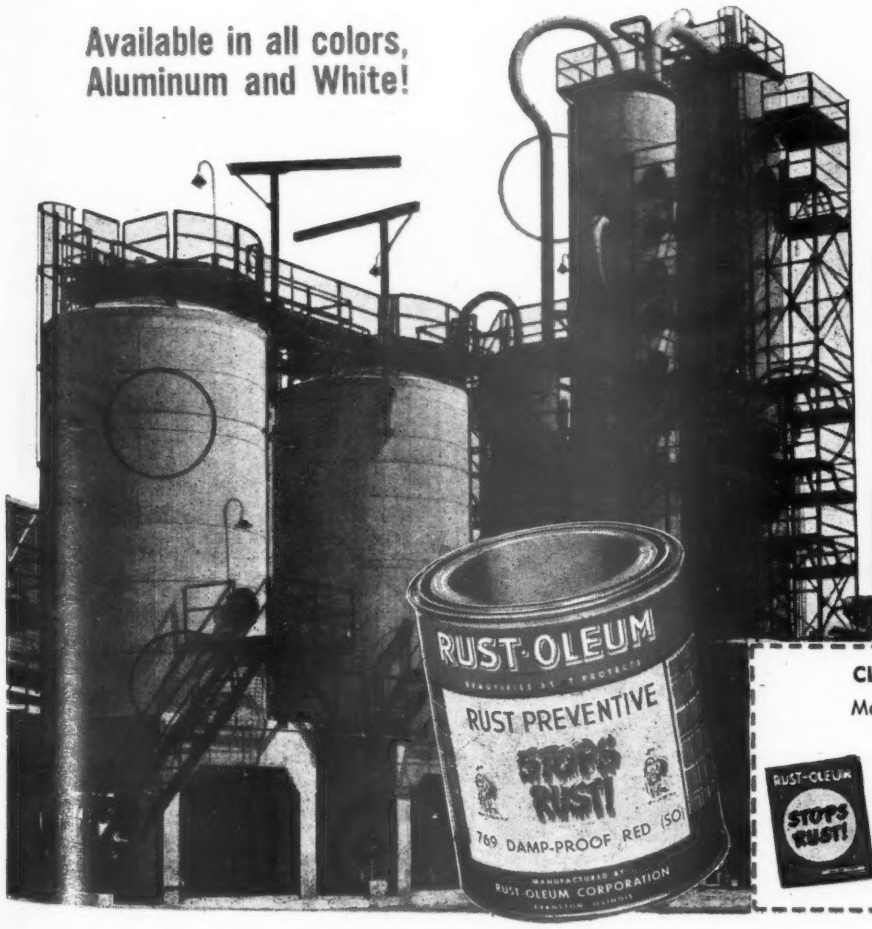
May be applied directly over rusted surfaces without removing all the rust!

RUST-OLEUM is the *practical, sensible* answer to your rust problems. Cuts your maintenance costs, because it may be applied *directly over rusted surfaces* after wirebrushing and scraping with sharp scrapers to remove rust scale and loose particles . . . costly sandblasting and chemical pre-cleaning are not usually required. This often enables *one man* to do the work of two with RUST-OLEUM! Practical, too . . . because RUST-OLEUM beautifies as it protects in *all colors, aluminum,* and *white.*

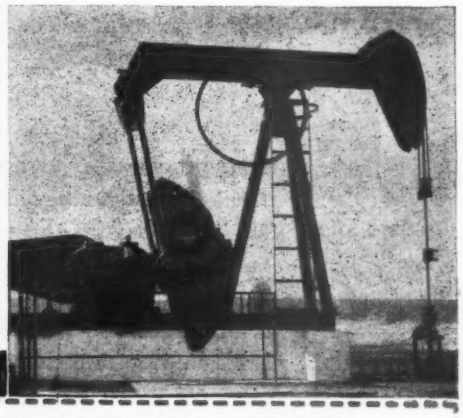
We'll be happy to show you convincing proof that RUST-OLEUM can cut your maintenance costs . . . and last longer when applied over rusted surfaces. Get the facts, today! Prompt delivery from Industrial Distributor stocks in principal cities in the United States and Canada.

RUST-OLEUM CORPORATION
2552 Oakton Street, Evanston, Illinois

Available in all colors, Aluminum and White!



Dries to a tough, elastic coating that resists fumes, moisture, heat, weathering, most acids and chemical dusts



CLIP THIS TO YOUR LETTERHEAD

Mail To: Rust-Oleum Corporation
2552 Oakton Street
Evanston, Illinois

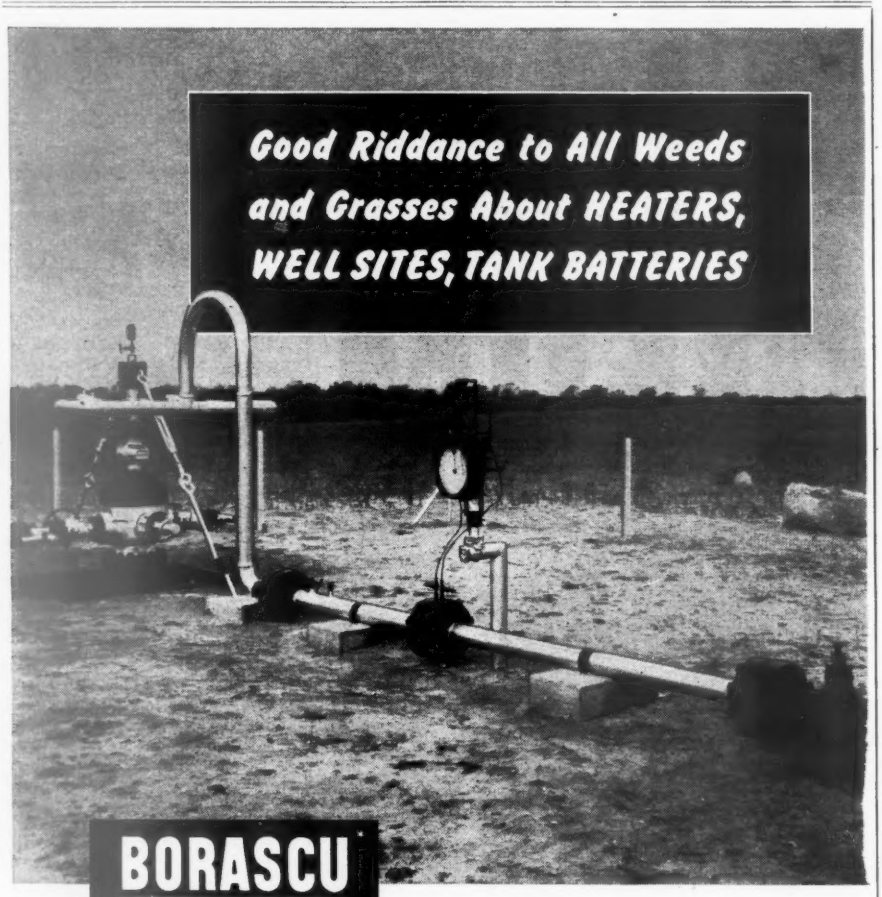
- ☐ Have A Qualified Representative Call
- ☐ Full Details On Free Survey
- ☐ Complete Literature
- ☐ Nearest RUST-OLEUM Source

▸ **Bert L. Stone** has become associated with Vickers Incorporated as manager of the petroleum pumping equipment division, at the company's plant in El Segundo, California. He will be assisted by O. G. Houser and G. H. Vickers, who will continue in the positions of sales manager and service manager respectively of the petroleum pumping equipment division, which they have held for a number of years. Stone was graduated from Washington State College.

B. L. Stone

▸ **Richard M. Burk** has been elected vice president of the Southwest Supply Company. He will be in charge of offices in Denver, Colorado, established by the company to serve the Rocky Mountain area. Burk had previously been identified with National Supply for more than 23 years.

▸ **Jack Wilcox,** president of S. R. Bowen Company, and **Dante Siracusa,** sales manager, recently made an extended visit to the company's stores and sales agents. They studied conditions in Texas, Louisiana, Oklahoma, Kansas, the Rocky Mountains, and Canada, and the introduction of several new Bowen tools in these areas.



BORASCU destroys weeds and grasses at a fractional cost of hoeing methods, etc. Enjoy substantial savings by using BORASCU about *your* tank batteries, well sites and heater units, just as many other petroleum producers do now. BORASCU destroys most vegetation; prevents future growth for 12 to 24 months, or longer, when correctly used! BORASCU and Concentrated Borascu are applied dry . . . with spray equipment, use our new, *non fire-hazardous* POLYBOR-CHLORATE-88.®

NONCORROSIVE* • NONPOISONOUS • NONFLAMMABLE • NONSELECTIVE

**To Ferrous Metals*

PACIFIC COAST BORAX CO.

DIVISION OF BORAX CONSOLIDATED, LIMITED

630 SHATTO PLACE • LOS ANGELES 5, CALIFORNIA

Weed Control Dept. Representatives located in: CHICAGO • NEW YORK CITY • NEW ORLEANS SEATTLE • PORTLAND, ORE. • CLEVELAND, OHIO • AUBURN, ALA. • KANSAS CITY, MISSOURI HOUSTON, TEX. • FT. WORTH, TEX. • AMARILLO, TEXAS • BOZEMAN, MONT. • MINNEAPOLIS, MINN. • SAN FRANCISCO • Home Office: 630 SHATTO PLACE, LOS ANGELES 5, CALIFORNIA

▸ **R. A. Childers,** president, Childers Manufacturing Company, Houston, Texas, has agreed to serve on the Aluminum Roofing Industry Advisory Committee for term ending August 1, 1952, at the request of the National Production Authority. Purpose of this industry advisory committee is to deal with industry wide problems resulting from material shortages and governmental controls, which necessarily result from the defense program.

C. K. Olson

P. W. Place

▸ **Charles K. Olson** has been appointed assistant general manager of The National Supply Company's engine division, Springfield, Ohio. For the last 19 years Olson was associated with The Whitcomb Locomotive Company, division of Baldwin-Lima-Hamilton Corporation. New staff assistant to the general manager is **P. W. Place.** Place joined the company in 1941 after graduation from the University of Wisconsin. **J. D. Myers** has been named general superintendent. Myers joined the company in 1936 as a drilling machine operator and became machine shop supervisor in 1942. Newly appointed general superintendent for all night shift operations is **P. A. Groeber.** Groeber joined the company in 1934 and since 1941 had been foreman of the machine shop.

▸ **David N. Hauseman,** retired brigadier general of the U. S. Army, has been appointed marketing executive of The Davison Chemical Corporation. General Hauseman resigned as president of Houdry Process Corporation of Philadelphia to join Davison's executive force. He was graduated from the University of Pennsylvania, Massachusetts Institute of Technology, and Harvard University.

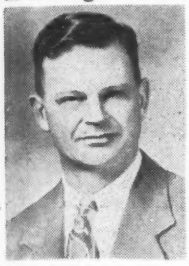
D. N. Hauseman

▸ **J. A. (Joe) Herron** will represent Rochester Ropes, Inc., in the California oil fields. Herron has been in California oil fields since 1911, exclusively identified with wire rope for more than 15 years. He was formerly with Wickwire and later with Wire Rope Manufacturing and Equipment Company. Headquarters are being maintained by Herron for Rochester Ropes at 21000 S. Normandie Boulevard, Torrance.

To obtain more information on products advertised see page E-41

Adin B. Capron has been named to the newly created post of chief engineer of the tubular products division of The Babcock and Wilcox Company. Capron's headquarters will be at Beaver Falls and he will direct the activities of the drafting, engineering development, maintenance, combustion, and methods engineering groups and be in charge of all plant construction. He was graduated from Brown University.

Allen F. White, Jr., has been named as manager of Southwest division, National Supply Company. He succeeds James M. Thompson, who died December 26. White joined National Supply shortly after his graduation from Louisiana Polytechnical Institute in 1937. In 1949 he was made store manager at Odessa, Texas, continuing there until April, 1951, when he was appointed assistant district manager of the Midland, Texas, district.



A. F. White, Jr.

Harry J. Conlan, assistant division engineer, eastern sales division, Hyatt Bearings Division, General Motors Corporation, has been transferred to the Pittsburgh office. He will hold a similar position for the central sales division.

J. F. Herold

H. E. McGowen

John F. Herold has been appointed vice president and sales director and **Harold E. McGowen** has been named chief engineer and head of research of Camco, Inc. Prior to joining the Camco organization Herold was export manager for Baroid with headquarters in Houston. He received a BS degree and a MS from Ohio State University.

McGowen received a BS in mechanical engineering from Texas A. and M. in 1941. For the last six years he has been with Richardson and Bass as district production engineer, Gulf Coast.

R. D. Houghton has been elected chairman of the board of directors of the Contractors Pump Bureau, an affiliation of the Associated General Contractors of America. Houghton, president of the Rice Pump and Machine Company, was elected at the 13th annual meeting of the bureau.

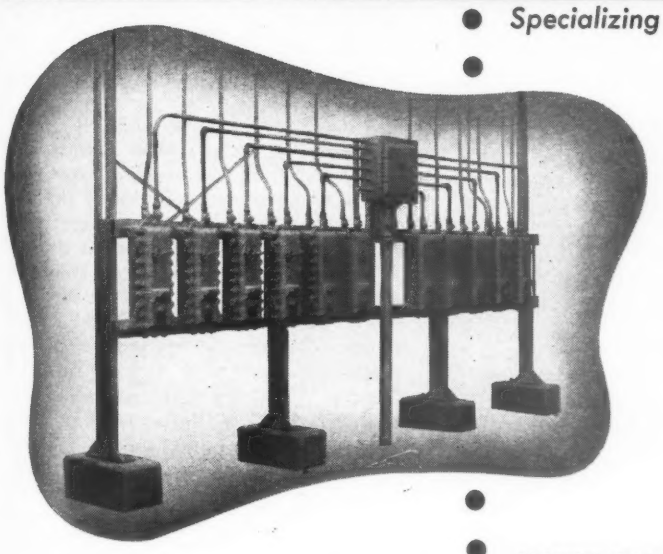
Kenneth W. Lineberry, president of Black, Sivalls and Bryson, Inc., **Marvin B. Marsh,** president of Marsh Steel Corporation, and **Albert R. Waters,** president of the Carter-Waters Corporation, have been named on the board of directors of City National Bank and Trust Company, Kansas City, Missouri. Prior to becoming chief executive officer of Black, Sivalls and Bryson in 1950, Lineberry was for 17 years an officer and member of the board of directors of the F. S. Yantis and Company of Chicago, one of the Mid-West's leading investment banking firms. Marsh founded his rapidly expanding business, which supplies steel and aluminum to industries, in 1945. Waters, president of Carter-Waters Corporation, takes on the board the place of the late E. Kemper Carter.

J. E. "Bill" White, Jr., has been named safety head sales representative for the Gulf Coast area by Black, Sivalls and Bryson, Inc. A graduate of Louisiana State University, White was formerly with Esso Standard Oil Company, South American offices. Later he was a consulting engineer in Dallas, Texas, and a salesman for the Vapor Recovery Systems Company in New York.

J. E. White, Jr.

NELSON ELECTRIC MANUFACTURING COMPANY

Specializing in Electrical Equipment for the Oil Industry



"NEMCO" Size 1 & Size 2 Explosion-Proof Combination Motor Starters with control stations in covers. Mounted above starters is a "NEMCO" Explosion-Proof Low Voltage Bus Box. Equipment was furnished for natural gasoline plant of a major oil company.

DESIGNERS and MANUFACTURERS of . . .

EXPLOSION-PROOF MOTOR STARTERS, AIR CIRCUIT BREAKERS, CONTROL STATIONS, JUNCTION BOXES and LIGHTING PANELS.

MOTOR CONTROL CENTERS . . INSTRUMENT PANELS and CUBICLES

SWITCHBOARDS . . . SWITCHGEAR . . . UNIT SUBSTATIONS

NELSON *Electric* MANUFACTURING CO.

217 North Detroit TULSA, OKLAHOMA Telephone 2-5131

▸ **Roy F. Brisbois** has been named as process pump specialist for Peerless Pump Division, Food Machinery and Chemical Corporation. Brisbois will devote his time to pump application problems in refineries, chemical process, and industrial plants, coordinating his efforts with the Peerless' field engineers and distributors. He was a member of the class of 1941, University of Southern California, specializing in mechanical engineering.

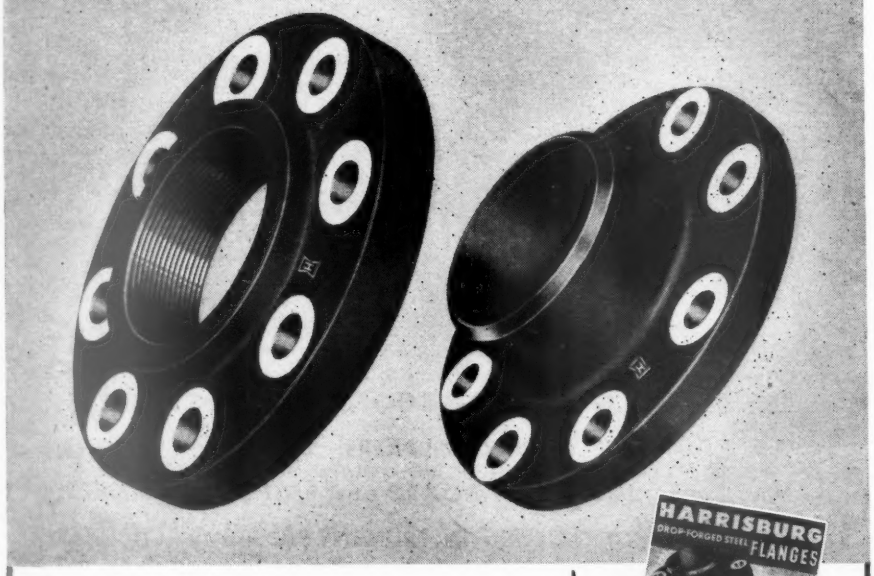
R. F. Brisbois

▸ **T. Baldwin Prickett** has been named planning manager of Du Pont's petroleum chemicals division. **Robert F. Harwick** became sales promotion manager; **Richard O. Bender** was appointed assistant technical manager; and **Arthur F. Bowe,** formerly manager of the Eastern district laboratory, at Deepwater Point, New Jersey, was appointed laboratory coordinator.

Prickett joined Du Pont in 1946 as a petroleum refining consultant. Harwick has been engaged in sales promotion work since he came with Du Pont in 1950. Bender came with Du Pont in 1941 and became head of the chemical division petroleum laboratory. Bowe joined Du Pont in 1947.

the character of the manufacturer shows in the product

Harrisburg Drop-Forged Steel Pipe Flanges are manufactured to A.S.A. Standards. Accuracy in machining produces threads that are virtually perfect in height, angle, taper, and gauging...the result of Harrisburg's 99 years of manufacturing experience.

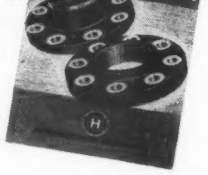


HF52-2

99 Years in Pennsylvania's Capital

Harrisburg Steel CORPORATION

HARRISBURG 7, PENNSYLVANIA



A copy of the Harrisburg Flange Catalog will be mailed, together with prices, upon request.

T. M. Lamberth, Jr.

R. W. P. Johnson

▸ **T. M. Lamberth, Jr.,** has been appointed to the Shreveport, Louisiana, office of The Cooper-Bessemer Corporation. The assignment as sales and engineering representative will be under the direction of **A. K. DeFrance,** branch manager of Cooper-Bessemer's office and warehouse facilities in Shreveport.

Roy W. P. Johnson has been appointed to the company's New York office. Prior to his engineering training on engine and motor-driven compressors at Cooper-Bessemer's factory in Mount Vernon, Ohio, Johnson was on contract with the Andian National Corporation as mechanical engineer in Colombia, South America. He is a graduate of Kingston-on-the-Thames Technical College in England.

▸ **Henry A. Mullen,** manager of the resistance welding division of Ampco Metal, Inc., has been named a member of the original advisory committee of the Resistance Welder Electrode Manufacturers Industry. This committee works in conjunction with the National Production Authority.

Ben R. Hecker has been appointed field engineer in the Detroit office where he will handle the sale of resistance welding alloys as well as other Ampco products.

▸ **Ralph Crowe** has been named manager of the Wichita Falls, Texas store of U. S. Steel's oil well supply division. Crowe has served as manager of "Oilwell's" Snyder, Texas store for the past 18 months. He succeeds **Fred Wellman,** who has been named manager of a new store and district warehouse which "Oilwell" recently opened at Odessa, Texas.

▸ **E. E. "Bill" Williams,** export representative for Technical Oil Tool Corporation, has just returned from two-and-one-half months of extended field work in Canada. Williams will leave shortly for New York, and thereafter will proceed to Argentina. Representing Totco and the Lucey Export Corporation, Williams will visit the oil producing areas of South America, Central America and Mexico, contacting users of Totco Recorders and other products in Lucey's full line of equipment.

E. E. Williams

▸ **C. J. Davy,** associated with Detroit Diesel Engine Division in Detroit since 1945, has been promoted to the division's petroleum industry sales office in Tulsa, Oklahoma. Prior to his appointment Davy served as liason between the factory and the Tulsa office. In his new capacity he will augment the sales staff of Arch M. Campbell, the division's manager of sales to the petroleum industry.

▸ **John Hendryx,** formerly design and estimating engineer of The J. B. Beaird Company of Shreveport, Louisiana, has been appointed sales engineer for packaged compressor plants. Before joining the Beaird organization, Hendryx spent two years with Texas Eastern Transmission Corporation and has held other positions as field engineer for a Texas oil producing company and as research engineer for an engine manufacturer. He attended Texas A & M college.

▸ **E. M. Converse,** senior vice president of Dearborn Chemical Company, has retired after almost a half century of service. Although his retirement is in keeping with company policies, Converse will continue to serve the company as necessary, according to R. A. Carr, Dearborn president. Converse began his long career in the Dearborn laboratory in 1902. He was responsible for the development of the company's NO-OX-ID rust preventive coatings and wrappers, producing the first inhibited rust preventives.

E. M. Converse

▸ **J. A. Cuneo,** formerly manager of the Chicago branch of Fairbanks-Morse and Company, has been promoted to the position of general sales manager. **H. L. Hilleary** will continue as assistant sales manager. **Milo C. Roy,** formerly manager of the Omaha branch, has been appointed manager of the Chicago branch. **J. W. Wright,** formerly manager of the diesel sales division, with headquarters in Chicago, has been appointed manager of the Omaha branch.

C. E. Dietle, formerly diesel department manager of Fairbanks - Morse's Chicago branch, has been promoted to the position of manager of the diesel sales division. **W. B. Wylly,** formerly manager of the Houston, Texas, subbranch, has been appointed manager of the Atlanta branch. **L. A. Weom,** formerly manager of the St. Louis branch, has been transferred to St. Paul where he has taken over the duties of branch manager succeeding A. C. Thompson who has retired after 45 years of service. **Clifford J. Schroeer,** formerly diesel department manager of the St. Louis branch, has been promoted to manager of the St. Louis branch succeeding Weom.

Also announced is an autonomous operation for two of the company's divisions, electrical and scale. Accordingly the following changes have been announced:

Gordon R. Anderson, manager of the Freeport works, has been promoted to the position of general manager of the electrical division. **W. H. Kingsley** is sales manager of the electrical division. Their offices will be in Freeport.

George C. Worthley, manager of the scale division, has been promoted to the position of general manager of the scale division, and **Joe Peterson** to the position of sales manager of the division. Worthley will have charge of both sales and manufacturing. **O. O. Lewis** is vice president in charge of sales.

▸ **V. J. Martzell,** Shreveport, Louisiana, was recently appointed assistant to the president of Superior Iron Works and Supply Company. Prior to his affiliation with Superior, Martzell was associated with United Gas Pipeline Company for a period of nine years. He resigned this position to go into business for himself, and organized the Gulf Southwest Service Company at Shreveport. He recently sold his interest in order to devote full time to Superior.

V. J. Martzell

In the American Tradition

PRESERVE YOUR FREEDOM!

American freedom, as outlined in the Declaration of Independence, is based on self-government—the ability of each of us to govern ourselves. Political government is meant to be only a balance wheel to prevent injustice and to preserve our God-given rights of life, liberty and the pursuit of happiness.

But when the power of our government is increased beyond this precise and restricted function, our individual liberties begin to disappear. Every grant of authority or power given to a political personality of any station . . . or to any political group, from the township through to and including the federal level . . . reduces our freedom.

Let's all strive to reverse the present trend towards more governmental power. Let's inform ourselves on the issues of the day . . . tell our political servants our views . . . and get back to governing ourselves.

GET

Maximum

- Weldability
- Strength
- Wear Resistance

with

SPANG

Boxes & Pins

The HIGHER STANDARD

SPANG CABLE TOOLS

made by SPANG & CO. BUTLER, PA.

for

OIL WELLS • GAS WELLS • ARTESIAN WELLS

SHOT BLAST HOLES • PROSPECT DRILLING

SPECIFY SPANG—FOR SALE BY DEALERS EVERYWHERE

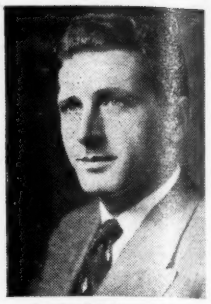
F. L. Tooley

T. A. Boyd

H. Wotkyns

Glenn Johnson

E. M. Gearke


J. L. Dickmann

▸ **Frank L. Tooley,** has been named executive vice president of the Baash-Ross Tool Company, it has been announced by L. F. Baash, president. Other promotions, made to keep pace with the expansion of the Baash-Ross organization now numbering 17 manufacturing plants, regional shops, and service headquarters throughout the nation, include: **T. A. Boyd,** secretary treasurer; **H. "Ink" Wotkyns,** vice president in charge of Mid-Continent operations; **Glenn Johnson,** vice president in charge of research and development; **E. M. Gearke,** general sales manager, and **John L. Dickmann,** chief engineer.

▸ **Lincoln D. Hall** has been named district manager, Tube Turns, Inc., in charge of the Mid-Continent territory. He will make his headquarters in the Wright Building, Tulsa. He succeeds **Robert S. Tyler, Jr.,** who has resigned to join the newly established Tyler-Dawson Supply Company, Tulsa. Hall received his B. A. from Pomona College and did post graduate work at University of Southern California.

L. D. Hall

▸ **H. M. Sossaman** was elected vice-president in charge of commercial development, Quaker Rubber Corporation, division of H. K. Porter Company, Inc., Philadelphia, Pennsylvania. Sossaman, who has been with Quaker for more than 23 years began as a salesman in the Florida district. **J. R. Lewis** succeeds Sossaman as general sales manager. Lewis joined Quaker in 1940.

▸ **J. S. Fluor** has been named president of the Fluor Corporation, Ltd., Los Angeles, and D. W. Darnell, former president, has been elevated to the chairmanship of the board. Darnell replaces **Shirley E. Meserve,** senior partner of Meserve, Mumper and Hughes, Los Angeles law firm, who will continue as chief counsel and member of the board.

Further organization changes included the election of **J. Robert Fluor** to the office of executive vice president, formerly held by J. S. Fluor. **James P. Wiseman,** vice president, and **Francis E. Fischer,** secretary treasurer, were reelected to their respective posts.

▸ **Lonnie D. Thompson** has been promoted to installation and service engineer in the Permian Basin area, by LeBus International Engineers, Ltd. Thompson has recently been in the engineering and design department of the LeBus Plant in Longview, Texas. He is a graduate of Texas Tech College.

L. D. Thompson

K. C. Slough

Kenneth C. Slough has been named sales representative for the Permian Basin area, for LeBus. Slough has previously been associated with LeBus in the capacity of sales representative for LeBus rotary tool works. He will be directly working on sales and promotion of LeBus grooving and wire line spooling systems. His headquarters will be in Odessa, Texas.

▸ **V. C. Judd** has been appointed as district sales manager of the Bendix radio division of Bendix Aviation Corporation. Judd will be in charge of the new Bendix radio sales office at 261 McDougall Avenue, Detroit. He has been with Bendix since 1941.

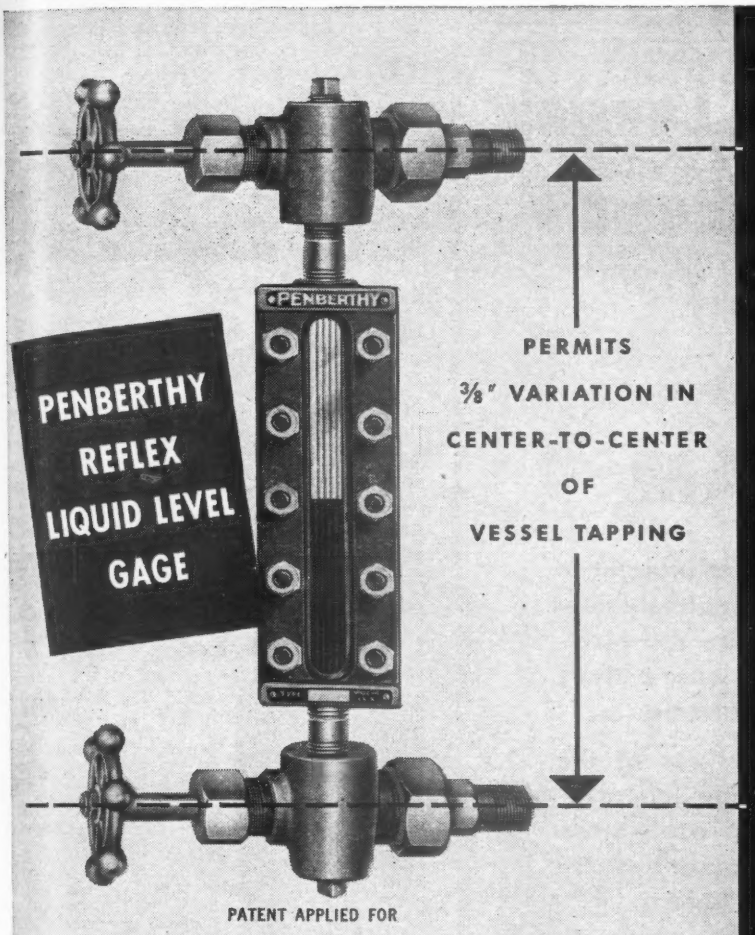
▸ **George C. Wilder** has been elected vice president and assistant general manager of Macwhyte Company. He has served as assistant to the general manager since January, 1949, and from 1946 to 1949 served as southern Wisconsin traveling representative for the company. He was graduated from Cornell University. Other officials of the company are: Jessel S. Whyte, president and general manager; H. E. Sawyer, vice president and treasurer; R. B. Whyte, vice president in charge of operations, and R. P. Tyler, vice president in charge of sales.

▸ **E. A. Booth,** general manager of sales for the Spang-Chalfant Division of The National Supply Company, has been given a six month leave of absence to serve with the National Production Authority in Washington, D. C. Booth assumed his new duties as chief of the pipe section of the iron and steel division of NPA on the first of the year. He has been relieved of his responsibilities with the company to allow him to devote his full time to the NPA post.

E. A. Booth

▸ **Oscar L. Garrett,** Petroleum Tool Company, Odessa, Texas, has returned to Mayo Clinic, Rochester, Minnesota. for a re-check.

J. S. Fluor, center, president-elect of Fluor Corporation, confers with D. W. Darnell, left, chairman of the board, and J. R. Fluor, executive vice president.



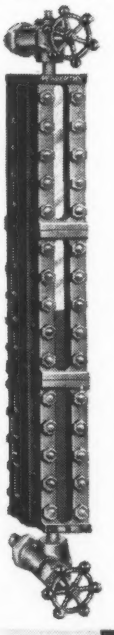
PATENT APPLIED FOR

Another PENBERTHY First

PENBERTHY "Floating Shank"

Saves Time and Money in Gage Installation

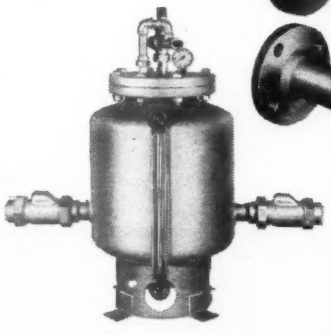
A feature available only on Penberthy drop forged steel (and alloy) gage valves, the "floating shank" automatically compensates for as much as 3/8" variation in the center-to-center distance of the vessel tapping. This saves time and cuts the cost of gage installation . . . eliminates stresses often induced during mounting. Penberthy "floating shank" is available at slight additional cost. It will pay you well to specify "floating shank" on your next gage order.



OTHER PENBERTHY PRODUCTS

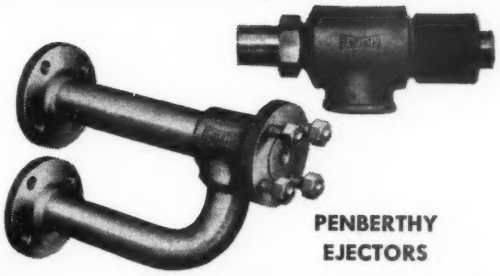
PENBERTHY TRANSPARENT GAGE

Used to observe color and density of liquids under high pressures and/or temperatures. Exceptionally sturdy construction —liquid chamber machined from solid block of metal. Ask for Catalog 35.



PENBERTHY CYCLING JET PUMPS

Automatically operated by air, gas or steam pressure . . . Will pump without clogging any liquid that will flow through pipes. Ask for Bulletin 5030.



PENBERTHY EJECTORS

A simple jet pump operated by air, water or steam. Needs no lubrication . . . will not get out of order. Made in wide variety of materials and special units developed to meet unusual conditions. Ask for Bulletin 512.

4671

PENBERTHY INJECTOR COMPANY

DIVISION OF THE BUFFALO-ECLIPSE CORPORATION

DETROIT 2, MICHIGAN

Established 1886 — *Canadian Plant, Windsor, Ontario*

Oil Companies Now Leasing Properties in Alabama

are cordially invited to locate offices in

BIRMINGHAM

Since Alabama's newest oil well was brought in by the Humble Oil Company in the completely new field near Brewton, there has been a marked acceleration of the already considerable oil lease activity in many counties in west and south Alabama.

Birmingham welcomes representatives of the many oil companies and others making leases or pursuing other activities in this State. To all those interested in oil developments in Alabama, this city extends an invitation to locate offices here.

An adequate amount of office space is now available since the removal of the Tennessee Coal & Iron Division of U. S. Steel Corporation into its new building which houses 1300 people.

Birmingham enjoys excellent communication facilities, a central geographical location and proximity to oil properties in Alabama, Mississippi and west Florida. Your representatives will find here comfortable hotel, apartment or residence accommodations and the complete cooperation of the members of the Birmingham Committee of 100.

* * * * * * * * * * *

Your inquiries addressed to this Committee or any of the undersigned members of the Executive Committee will receive immediate attention

BIRMINGHAM COMMITTEE OF 100

1914 Sixth Ave., N., Birmingham, Ala.

Executive Committee

Gordon Persons
Governor
State of Alabama

Bradford C. Colcord
President
Woodward Iron Co.

John S. Coleman
President
Birmingham Trust National Bank

Donald Comer
Chairman of the Board
Avondale Mills

William P. Engel
President
Engel Companies

W. W. French, Jr
President
Moore-Handley Hardware Co.

Clarence B. Hanson, Jr.
Publisher
The Birmingham News

W. H. Hoover
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Employers Insurance Co. of Alabama

Mervyn H. Sterne
Sterne, Agee & Leach

Claude S. Lawson
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Sloss-Sheffield Steel & Iron Co.

Thomas W. Martin
Chairman of the Board
Alabama Power Co.

J. C. Persons
President
First National Bank

O. W. Schanbacher
President
Loveman, Joseph & Loeb

A. V. Wiebel
President
Tennessee Coal, Iron & Railroad Co.

David Larkin

A. A. Grosse

David Larkin, former executive vice president of Broderick and Bascom Rope Company, was elected to the board of directors. At the meeting of the new board for the election of officers, **A. A. Grosse,** who has been assistant treasurer, was elected to the additional office of secretary, a position formerly held by **Joseph H. Bascom,** now executive vice president and treasurer. Grosse's connection with the organization dates back to 1925.

Fred L. Goldsby has succeeded W. D. Robinson, who has retired in the Chicago Bridge and Iron Company's Export department at 165 Broadway, New York City. Goldsby joined Chicago Bridge and Iron in 1927 and worked in various departments. He has been in charge of foreign erection department at New York since 1947. He attended Bradley Polytechnic Institute (now Bradley University) at Peoria, Illinois, and was graduated from the University of Illinois.

F. L. Goldsby

John J. B. Rutherford, metallurgist, tubular products division, The Babcock and Wilson Company, has been appointed a member of the Interim Advisory Committee on Alloy Steels of the American Petroleum Institute. F. M. Porter, president of the American Petroleum Institute, in appointing the committee stated that its assignment is "to secure adequate consideration of the industry's problems incident to conservation, substitution and essential uses of alloy steels as may be necessitated by shortages of alloys."

W. J. (Jimmy) Llewellyn and **W. C. (Bill) Hull** have recently joined the sales organization of Well Equipment Manufacturing Corporation. Llewellyn, who will make his headquarters in Lubbock, Texas, to serve the Texas Panhandle and New Mexico, is a graduate of Texas Christian University. Hull will have headquarters in Russell, Kansas, from where he will cover the oil fields of Kansas.

W. J. Llewellyn

C. E. Cromwell

J. H. Metzgar

C. E. Cromwell has been appointed sales manager of the commercial division of the De Laval Steam Turbine Company. A sales engineer from 1939-1949, and district manager of the Detroit office from 1949-51, Cromwell is a graduate of the Rose Polytechnic Institute.

J. H. Metzgar has been appointed sales manager of the standard products division of De Laval. Prior to his appointment, Metzgar had been a De Laval sales engineer. He is a graduate of Lafayette College.

Kenneth C. Towe was elected president of American Cyanamid Company at a meeting of the board of directors on Tuesday. He succeeds the late **Raymond C. Gaugler,** who died suddenly January 11. Towe has been a director of the company since 1939.

K. C. Towe

The new president has been associated with the Cyanamid organization since 1926 when he joined the company as a member of the accounting department. In 1945, Towe was promoted to vice president in charge of finance, a position he occupied until his election as president.

Jesse H. Plummer, vice president of Glass Fibers, Inc., has also been appointed general factories manager of the firm. His new duties put him in charge of all engineering activities and factory operations. Dr. Plummer was educated at the University of the South and Johns Hopkins University.

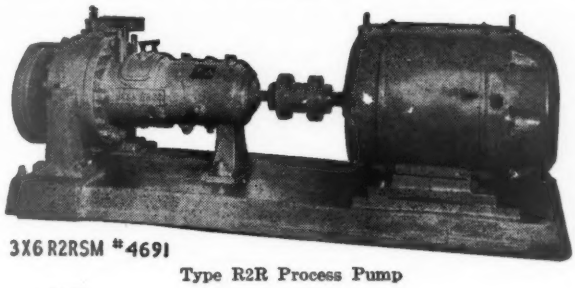
Raymond F. Mensing, vice president and treasurer of Glass Fibers has been assigned additional duties as general business manager of the firm. In addition to finance and general accounting, he will now supervise all purchasing, personnel and sales-production coordination activities for the company.

Raymond W. Capaul was elected vice president and general sales manager of the company. Capaul joined Glass Fibers in 1948 as electrical division manager and was promoted to general sales manager in July 1949.

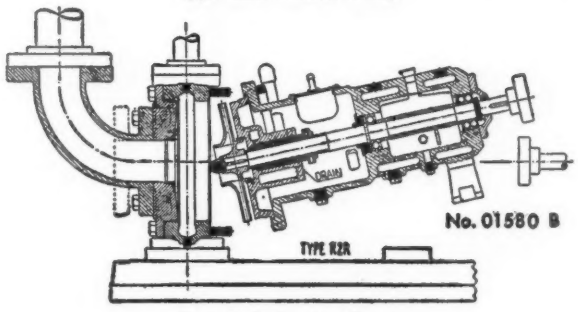
F. J. Solon, Jr., at a recent meeting of the board of directors, was elected vice president-advertising and public relations of Glass Fibers, Inc. Solon joined the company in 1947.

DEAN BROTHERS PUMPS INC.

Type R2R Centrifugal Process Pumps



Type R2R Process Pump



Type R2R Process Pump

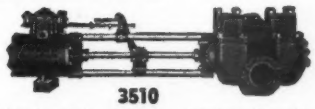
DISASSEMBLY: The Type R2R process pumps can be disassembled without disconnecting the suction and discharge piping. By first removing the spacer from the spacer type coupling, and unbolting the casing from the cradle the entire cradle and complete rotating element can be removed without disturbing the suction and discharge piping.

OPERATING RANGE: Type R2R, Heavy duty, process pumps are available in eighteen different sizes, enabling our engineers to furnish units specially designed and constructed for the particular work to be performed.
Capacities: 50 to 2000 Gallons per minute.
Heads: Up to 400'. **Speeds:** 900 RPM to 4000 RPM.

BUILDERS OF OUTSTANDING PUMPS SINCE 1869

CENTRIFUGAL and RECIPROCATING PUMPS

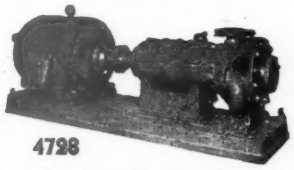
Close Coupled Centrifugal Pump



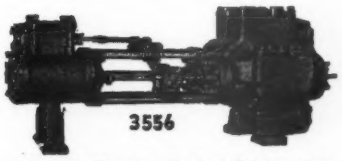
Horizontal, Single Style, Double Acting, Piston Type, Close Clearance Pump. Designed to handle volatile liquids

Pedestal Mounted Centrifugal Pump

Horizontal, Duplex, Double Acting, Side Pot, Piston Type, Oil Bath Power Pump



Double Pedestal Bearing Centrifugal Pump



Durable Duplex Packed Piston Pattern Steam Pump, Side Pot Type

ESTABLISHED 1869

DEAN BROTHERS PUMPS INC.

INDIANAPOLIS IND.

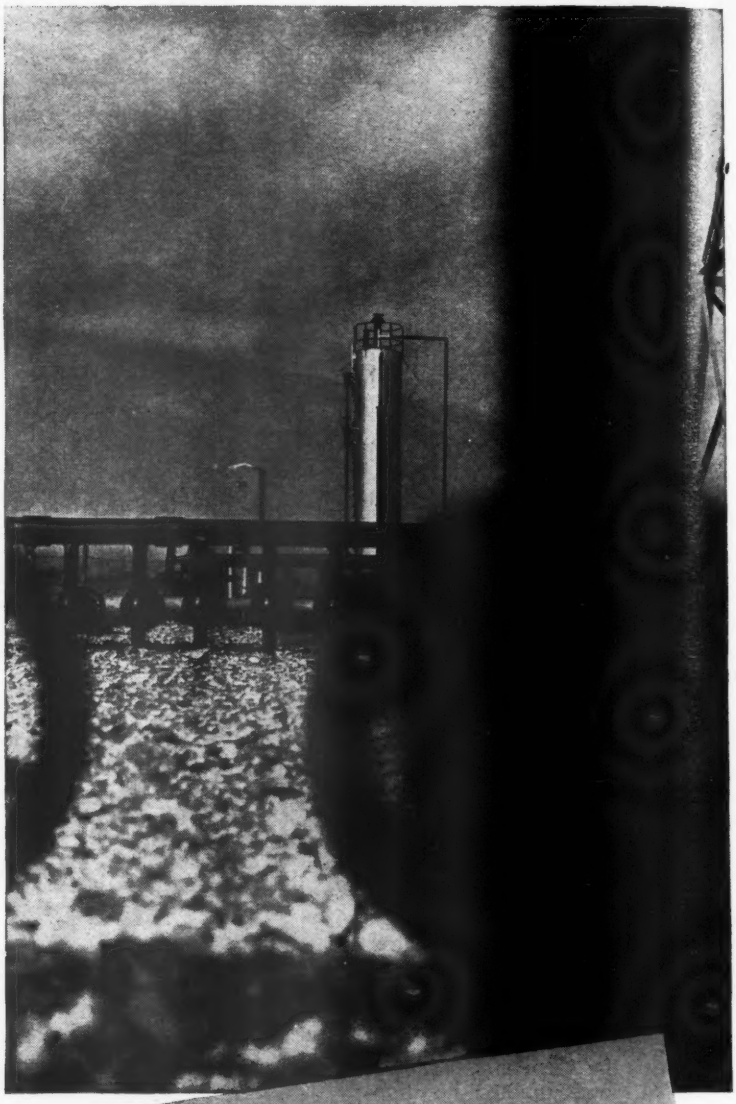
323 W TENTH ST.

Branch Offices: NEW YORK, N. Y., HOUSTON, TEXAS

Representatives in Principal Cities

To obtain more information on products advertised see page E-41

WHERE *Visco* TREATMENT PAYS OFF



PAYOFF on any lease is treated oil acceptability . . . and that is where Visco Emulsion-Breaker speed and efficiency give you assurance that every tank is sold, every time.

Get Visco treating advantages on your lease now — to assure consistent payoffs at the pipelines . . . And to prove, on *your oil*, that real emulsion-breaker economy shows up in the cost per barrel of dry oil *sold*.

VISCO PRODUCTS COMPANY
INCORPORATED
City National Bank Building
Houston 2, Texas

Phone Houston, CAPITOL 7300, collect, for Visco Service that matches Visco Chemicals — fast, efficient, economical!

Visco CONSISTENTLY EFFICIENT
DEHYDRATING AND DESALTING CHEMICALS

NOTICE: Visco Products Company is authorized to manufacture and sell Visco Oil Treating Compounds for use in the breaking and resolving of oil emulsions, or to grant licenses for such use, under the following United States Letters Patent: 2,050,639; 2,050,640; 2,206,589; 2,214,783; 2,214,784; 2,225,189; 2,303,414; 2,307,813; 2,318,034; 2,318,035; 2,321,066; 2,335,554; 2,454,808; 2,514,399. Visco Products Company is willing to grant licenses on a royalty basis, to oil companies, and to others desiring to practice the patented subject matter, under any and all of the above Letters Patent, permitting the user to purchase the oil treating compounds at will from any vendor, or to prepare the compounds for use or to use the compounds under the above Letters Patent. Application for license should be made to: **Visco Products Company,** Houston, Texas.

New Machinery and Supplies

Use reply card to procure promptly complete information and prices of products described here in brief.

Circle corresponding letter or letters on reply card.

(A) ROCK BITS

Globe Oil Tools Company now offers a complete line of "2-Cutter" integral jet rock bits. Globe Jet rock bits pioneered the integral jet nozzle and have earned wide recognition for their out-

standing performance. They incorporate the same features that have proved so popular with the conventional Globe "2-Cutter" rock bit, including the largest bearing area introduced in a roller type bit of comparable size. The company claims the bits have extra large cutters that have the longest teeth consistent with maximum bearing capacity. The Globe jet bits are made in a complete range of sizes from 8⅝ to 16 in. with either 9/16, ⅝, 11/16 or ¾ in. Tungsten-Carbide jet nozzles.

Circle letter (A) on reply card.

(B) PROCESS PUMPS

To pump petroleum hydrocarbons, water, and chemical solutions at elevated temperatures and pressures, Peerless Pump Division, Food Machinery and Chemical Corporation has recently introduced a new process pump, designated as the Peerless Type PR. General characteristics show that the Type PR pump provides capacities up to 1000 gal per minute and operating heads up to 625 ft. Temperatures of liquids pumped can be up to 850 F. Horizontal electric motor drive is standard but others such as steam turbine or stationary engine can be supplied. The pump's liquid end can be supplied in cast iron, bronze, carbon steel, stainless steel, or other materials as required by intended application or service. Two models are offered, one with top suction—top discharge, the other with end suction—top discharge, to suit existing or planned piping arrangement.

Circle letter (B) on reply card.

(C) PACKING ASSEMBLY

Uniflex packing unit for use on Type "R" and "MU" swivels is a new wash pipe packing assembly announced by National Supply Company. Effective immediately, all Types "R" and "M" swivels produced at the Torrance, California, plant will incorporate the new packing arrangement. The former "R" and "MU" swivels equipped with the new packing will henceforth be known as Type "RB" and "MUB." The Uniflex design is such that it readily can be applied to existing "R" and "MU" swivels and two conversion kits are available:

(A) Kit No. 701735-G contains all parts, including a new gooseneck.

(B) Kit No. 701735-G1 contains all parts except a gooseneck, but includes an adapter to be used by remachining the present gooseneck.

Circle letter (C) on reply card.

(D) TRACTOR-SHOVEL

The Frank G. Hough Company has made available another four-wheel drive payloader tractor-shovel. It has a one-cubic yard bucket with 60 hp diesel or 54 hp gasoline power optional. This Model HR payloader is similar to the big 1½ yd Model HM. The use of large pneumatic tires, same size all around, and drive on all four wheels gives it traction and flotation to work in sand, and mud.

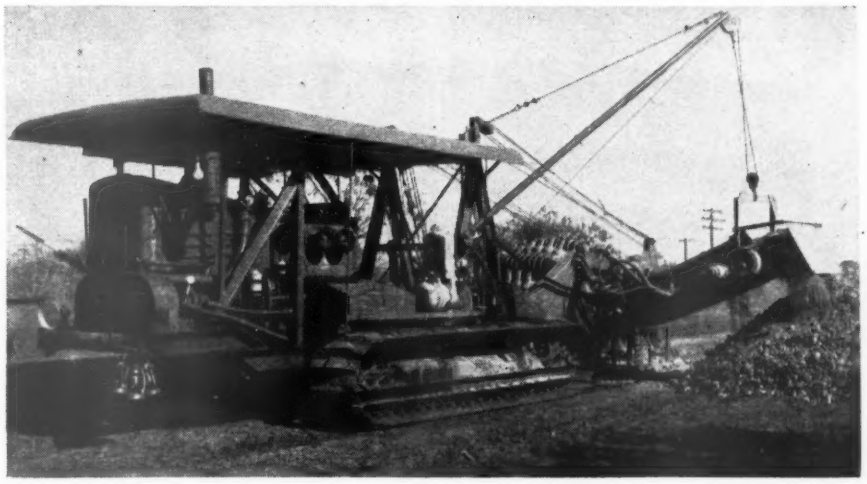
Circle letter (D) on reply card.

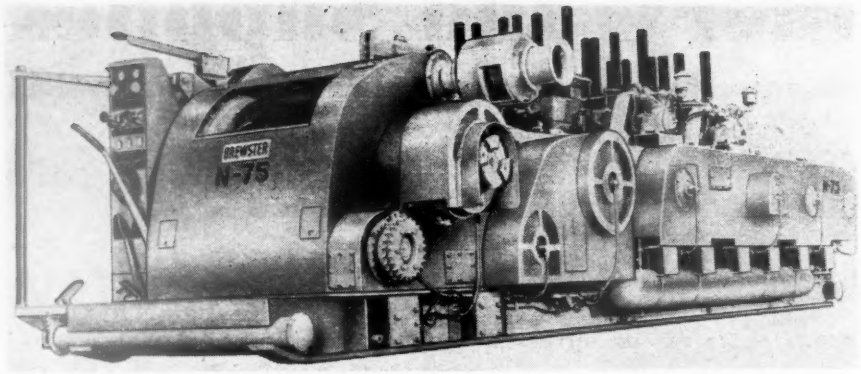
(E) DITCHING MACHINE

Crutcher-Rolfs-Cummings, Inc., has recently announced production of the Middle-Incher ditching machine, a companion to the Big-Incher which C-R-C introduced to the pipe line industry in 1949. The Middle-Incher is the first pipe line ditching machine of its size to utilize hydraulic power to replace the gear and sprocket drives which have been typical of every other similar machine since the first pipe line ditching machine was built about 1900. An outstanding advantage of the hydraulic power system is the fact that the speed of the conveyor works independently of the speed of the digging wheel. The hydraulic system permits finger-tip control of the instruments. Elimination of gears and sprockets has also resulted in lower maintenance costs.

Circle letter (E) on reply card.

Ditching machine utilizing hydraulic power to replace gear.





Brewester drawworks for 10,000 ft drilling rig.

(F) DRAWWORKS

A new drawworks for 10,000 ft drilling rig has been announced by The Brewster Company. A development of the Brewster N-7, it is known as the N-75. Incorporating the basic design of the N-7, it has more power, being upped from 600 to 700 hp, and is more ruggedly constructed throughout. A larger diameter and longer drum core has been incorporated to reduce wear on wire lines . . . larger chains have been installed on the high and low drum drives . . . and an auxiliary positive clutch has been built into the low drum friction clutch as an added safety feature. The new model has eight line speeds and four rotary speeds available, with four speed forward, two reverse.

Circle letter (F) on reply card.

(G) WELDING POSITIONERS

A new line of medium duty welding positioners was recently announced by the Reed Engineering Company. Two standard sizes are available, Model P-10R with a 1000 lb capacity, and Model P-25R with a 2500 lb capacity. The new design features a compact, three-in-one table tilting frame. This eliminates the indirect, inefficient power transmission trains used on older types of equipment, and reduces to a minimum backlash and lost motion in the table rotation system. Rotation speed can be varied through a 10 to 1 speed range by means of a conveniently placed handwheel adjustment. Both models are available with either hand or power tilting of the table through a 135 deg angle.

Circle letter (G) on reply card.

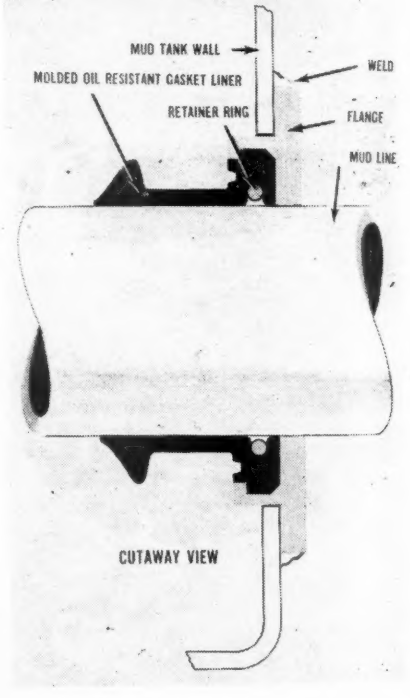
(H) DYE FORMULA

Completion of a new, improved, and non-toxic Dy/Chek formula was announced recently by Turco Products, Inc. The Dy/Chek method of inspection is basically a "hide and seek" process. After pre-cleaning, a red dye is applied to the surface being inspected. After being allowed to dwell sufficiently long for it to "hide" in any flaw or defect—no matter how small—that extends to the surface, the dye is removed from the surface of the part being inspected. A white developer is then applied to the surface being inspected. This developer "seeks" out the dye "hidden" in the flaw. As the developer dries, it pulls the "hidden" dye to the surface. The red dye thus bleeds into the white developer, marking with photographic clarity any defects — as well as their extent—that may be present.

Circle letter (H) on reply card.

(I) FLEXALINE CONNECTOR

The PB flexline connector developed by Byron Jackson Company, is a simple, flexible, and quickly-installed connection that allows the use of plain end pipe for connecting two mud tanks or



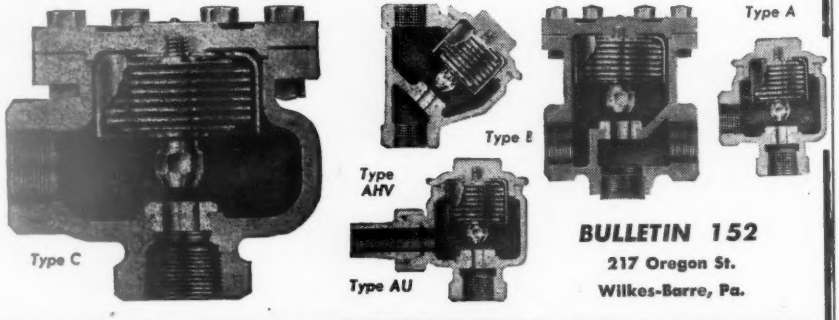
between the pump suction and a mud tank. It provides positive, leak-proof sealing . . . allows for angular variations as high as 10 deg . . . eliminates the need for spotting tanks the same distance apart on each location (as plain end pipe can extend into the tank as far as necessary). The PB flexline connector consists essentially of a steel flange welded to the mud tank, a molded packing element, and a retainer ring. The flexline connector serves as a flexible joint and absorbs pump pulsation.

Circle letter (I) on reply card.

Nicholson Traps Help

CUT STEAM COST $500,000 A YEAR

At one of the nation's large processing plants a campaign to promote economical steam use by improving heat transfer efficiency has resulted in a yearly saving of $500,000. Credit for a fair portion of this is given to improved steam trapping, which resulted from the installation of Nicholson thermostatic traps. To see why an increasing number of leading plants are standardizing on Nicholsons for positive drainage and faster heat transfer, send for Bulletin 152.



BULLETIN 152
217 Oregon St.
Wilkes-Barre, Pa.

W. H. NICHOLSON & CO.
TRAPS · VALVES · FLOATS

(J) DRAIN VALVE

The Strahman ram type drain valve has been designed to prevent clogging. In the open position a full and unobstructed flow is assured as the piston or ram is drawn down into the bonnet leaving a completely open passage for the material. In the closed position the piston is forced up into the vessel pushing aside any matter that might tend to create clogging thus assuring a clear outlet. With the Strahman ram type drain valve, rodding is not necessary. As there is no conventional gland, stuffing-box problems are eliminated. The piston moves through 2 resilient rings on which proper tension is maintained by compression nuts. Strahman Valves, Inc.

Circle letter (J) on reply card.

(K) CHOKER SLING

A choker sling fitting has recently been perfected by Electroline. The new sling fitting employs two overlapping and coacting hooks, which are easily applied to a wire rope to form a loop of any desired size. The rope cannot be freed from the sling until both hooks are disengaged manually thus preventing accidental release. Another feature of the design is that the hooks are joined to the fitting portion of the choker sling fitting by a pivot, which allows the unit to conform automatically to the size of the load, according to the manufacurer. Electroline Company.

Circle letter (K) on reply card.

(L) ELECTRODES

A new line of hard-facing electrodes and acetylene welding rods is announced by Metal and Thermit Corporation. The new electrodes, recently added to the Murex line, include rods for extreme abrasion, madium and heavy impact, severe shock, high red hardness, and extreme heat and corrosion resistance. In addition, there is a new Murex tungsten-carbide rod which provides an exceptionally slag-free deposit, allowing all residue to be readily cleaned away by wire brushing.

Circle letter (L) on reply card.

(M) VACUUM FILTER

Oliver United Filters, Inc., has announced a new continuous vacuum filter with vapor tight hood for handling, in this case, an exceedingly toxic product. The same design would be used for handling inflammable products or those which must be handled in an inert or special atmosphere to prevent oxidation or other chemical changes. A similar design has been adapted to the Oliver continuous precoat filter making it practicable to handle solutions with relatively small amount of solids or with sticky, slimy, hard-to-discharge cake. Arrangements are made to keep the space surrounding the filter slightly on the vacuum side to prevent the escape of gases or fumes.

Circle letter (M) on reply card.

(N) IMPACT TOOL

A new Thor 3/8-in. portable pneumatic reversible impact wrench is announced by Independent Pneumatic Tool Company. Now in production at the company's main Aurora, Illinois works, the new wrench features the same basic impacting mechanism as the Thor "Silver Line" universal electric impact tools now in use in industry, automotive service and general maintenance.

Key feature of the tool is an exclusive rolling ball type cam that increases efficiency and steady functioning of the impacting mechanism. The new wrench available with two types of spindles—a Size 24 with 1/2-in. square drive, and a Size 24S with a 7/16-in. hexagon quick change chuck integral with the spindle.

Equipped with convenient side handle and trigger type throttle, the new wrench weighs only 5¾ lb, and measures 8 11/16 in. in length. A reversing valve is situated at the back of the tool.

Circle letter (N) on reply card.

(O) RING SETS

Operators of diesel engines of large bore can get from Wilkening Manufacturing Company, not only the individual ring designs, but also complete ring installations, the company has announced. Each set has been worked out and applies to only one model of engine. The sets are made up in cylinder units so they can be ordered easily for any of the multiple-cylinder combinations in service. A distinguishing characteristic of Pedrick engineered sets for big-bore engines is the use of latest designs of flexible oil rings. A flexible and successful conformable rings, for large cylinders, according to Pedrick, is the DO8 or Formflex type. Because it has two thinner-section cast-iron units in the groove, it has axial as well as radial conformability. An entirely-different peripheral-abutment-type expander called an "Equalizer" is used. It does not contact the bottom of the piston groove.

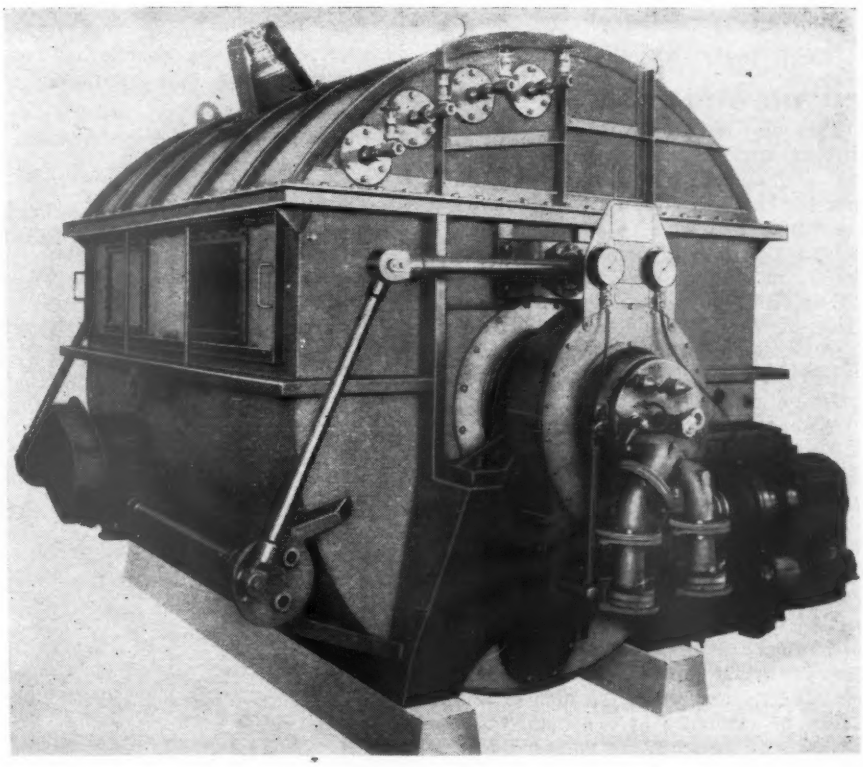
Circle letter (O) on reply card.

(P) LOST CIRCULATION ADDITIVE

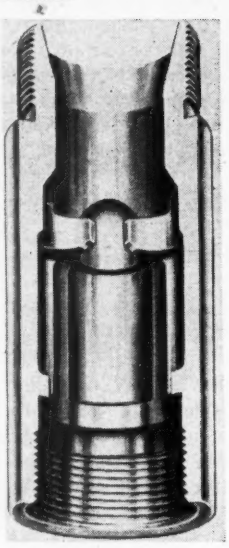
The William E. Sievers Corporation and Sievers Company have introduced Queenseal, sister product to Kingseal, an additive to prevent and eliminate lost circulation in oil well drilling. Queenseal, a bulk product, was distinctly developed for lost circulation areas that require masses of material, and priced competitively with other bulk additives currently on the market. It is composed of carefully processed inert wood fibers, strong pliable textile fibers, and resilient selected particles of white pine sawdust. This exceptional combination in one product means exceptional results, as the several ingredients complement each other. First, the bulk, or processed inert wood fibers, create a strong firm base. As this base forms within the enlarged cracks, crevices, fissures, or caverns, the fine textile fibers interlace with the coarser bulk material, forming a mesh. The particles of sawdust, fit between the interlocked fibers, adequately plugging the interlaced interstices and forming a most effective lock, the manufacturer has reported.

Circle letter (P) on reply card.

Oliver United's new continuous vacuum filter with vapor tight hood.



(Q) CLOSED GAGE



A new closed cage that is said to increase valve life and contribute to greater pumping efficiency is announced by the D + B Division, Emsco Derrick and Equipment Company. The cage is now being made in all sizes and is available in Armored and Endurall (stainless) steel, the latter for corrosive pumping conditions. The design of the cage provides fluid passage through the cage greater than the fluid passage through the seat. The new design speeds seating and reduces ball spin by directing the full impact of the fluid load on the ball through a center opening in the ball pumper.

Circle letter (Q) on reply card.

(R) DUCTING SYSTEMS

Ducting systems for chemical plants made of tough, corrosion-resistant plastic are now being manufactured on a large scale by the mechanical goods division, United States Rubber Company. Tanks, liners, trays, hoppers, feeders, fume exhaust hoods, washers, stacks fume troughs, and gutters are being specifically engineered for the handling of acids, alkalies, aliphatic hydrocarbons and other basic chemicals. U. S. Rubber is using a blend of styrene plastic and acrylonitrile rubber as the major construction material. The equipment is an "all plastic" assembly.

Circle letter (R) on reply card.

(S) ARC WELDERS

The new Model GA "Wasp" direct current arc welders, available in 150 and 200 ampere sizes, have been announced by Air Reduction Magnolia Company, a division of Air Reduction Company, Inc. Designed to further advance the efficient performance of the Wilson line, the volt ampere characteristics of these machines make them especially suited to DC straight Polarity Heliwelding with Thor-Tung. Excellent commutation at all settings, plus the advantages of self-excitation and split-pole, cross-field design provide good operation at all current settings.

Circle letter (S) on reply card.

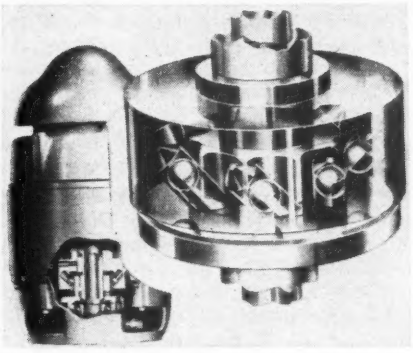
(T) TILT TRAILER

A new heavy-duty gooseneck-type trailer with tilting platform for transporting heavy machinery with standard fifth wheel tractors, has just been announced by La Crosse Trailer Corporation. The trailer is easily loaded or unloaded in 5 minutes by one man, without skids or blocking, the manufacturer claims. Available in 14, 18, and 22 ton capacity the new model GTTA trailer is of tandem axle design, with 96 in. width platform, which tilts into loading position by releasing simple lock at front of platform. Two double-acting hydraulic cylinders "cushion" load during tilting. After load is driven or winched into place, platform locks automatically in horizontal position for hauling. Trailer is ruggedly constructed with one-piece formed gooseneck and subframe.

Circle letter (T) on reply card.

(U) BACKSTOPS

When electric motor current ceases, a vertical turbine water pump backspins unless means are provided to prevent motor reversal and avoid damage to pump bearings. A new method of preventing reversal of U. S. vertical hollow-shaft motors has been developed by



U. S. Electrical Motors, Inc. By using balls, the geometric form most ideally suited to provide quick engagement and maximum strength, U. S. Ballomatic—a backstop that depends on natural laws to give quick-acting, dependable service. When the motor starts, centrifugal force throws the hardened steel balls out of engagement with the stationary member. When the motor stops, gravity pulls the balls down and one of them engages between the rotating member and the stationary ratchet, thus preventing reversal.

Circle letter (U) on reply card.

(V) GAS CUTTING MACHINE

The Airco No. 20 Radiagraph has been announced by Air Reduction Magnolia Company, a division of Air Reduction Company, Inc. It is the latest addition to Airco's famous line of gas cutting machines. It is the first machine of its type specifically designed to be used as a travelling carriage for mounting such equipment as the Aircomatic[R] machine and the Heliweld machine holder in addition to fulfilling the requirements of a portable, motor-driven, straight-guided cutting machine. The transmission is a self-contained unit, the entire operating mechanism is mounted as a unit and all internal parts are easily accessible.

Circle letter (V) on reply card.

(W) GAS ENGINE

The Ajax 5 in. by 6½ in. gas engine, a new oil well pumping unit in the 5 to 12 hp range, has been introduced by Ajax Iron Works. Designed for low operating and maintenance costs, this new development incorporates construction improvements never before applied to gas engine practice. The engine has been designated Model WL. This refers to its wet-type cylinder liner, which is easily replaced in the field and eliminates oversize pistons and rings.

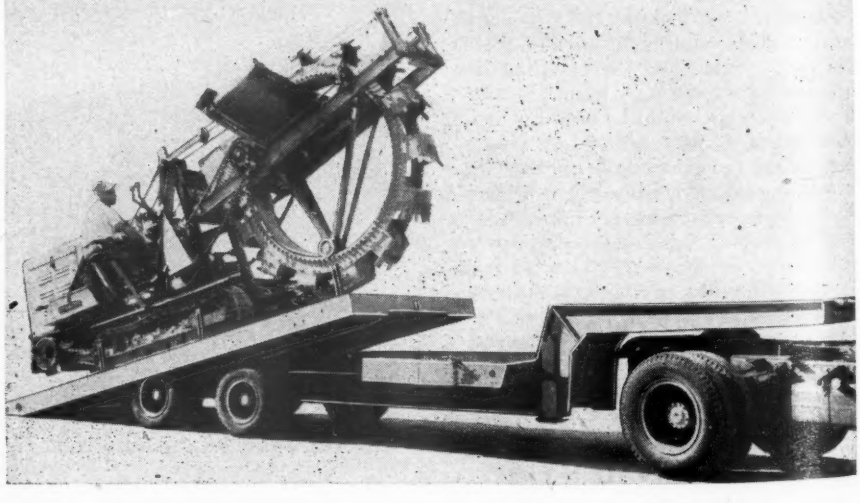
Circle letter (W) on reply card.

(X) PIPE-WRAPPING

Royston Laboratories, Inc., announces a new product added to its line of pipe line and industrial protective coatings. The new product is Glas-Wrap, a special pipe-wrapping fabric for reinforcing Roskote Cold-Applied Mastics as a protection against mechanical abrasion during handling the pipe and backfilling the pipe line. The fabric is an open mesh weave that permits rapid evaporation of Roskote solvents. The product is especially designed for hand-wrapping and will not irritate even the most sensitive skin. The fabric is applied between two layers of Roskote.

Circle letter (X) on reply card.

La Crosse trailer shown with platform tilted. The trailer is used in transporting heavy machinery with standard fifth wheel tractors.



Trade Literature

Publication will be sent free.

(Y) METERING INSTRUMENTS

%Proportioneers, Inc.% has published a 16-page bulletin titled, "Streamlined Materials Handling in Continuous Production." It is a reprint of a talk given before the Akron, Ohio, chapter of the American Institute of Chemical Engineers by Rudy P. Lowe, president of %Proportioneers, Inc.%. Numerous line-drawings, pictures, and charters illustrate the material in the article. Lowe gives a short review on the fundamentals underlying fluid as well as solid metering, the accuracy and flexibility of which plays an important part in any continuous compounding process.

Circle letter (Y) on reply card.

(Z) CANVAS BELTING

Latest information on the uses of stitched canvas belting is provided in the new belting catalog issued by the belting division of C. R. Daniels, Inc. For many years outstanding producers of canvas products for industry, C. R. Daniels, through its belting division, has now developed new treatments and techniques for prolonging the life and strength of stitched canvas conveyor and elevator belting. New impregnating compounds that completely saturate the belt fibres, new stretching methods and many other items of interest are described in this new catalog. The catalog also gives complete details for ordering, installing, and maintaining eight specific types of belt, plus specific special belting through the Dandux engineering department.

Circle letter (Z) on reply card.

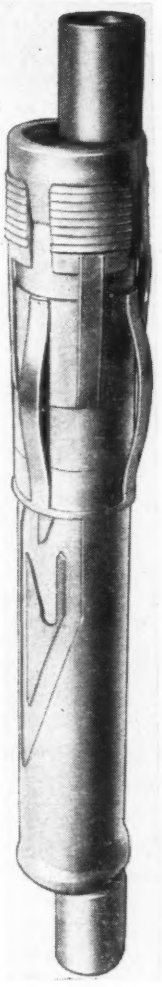
(AA) WATER FILTRATION

A technical bulletin, No. B-12W, is now available from Dicalite Division, Great Lakes Carbon Corporation. Title of the bulletin is "Clarification of Water by Filtration." It is especially helpful for the man interested in the clarification of water by filtration for reclamation and re-cycling in industrial processing, prevention of pollution in waste disposal, purification of domestic and industrial potable supply. To a greater or lesser extent the concern of the present water supply is of national scope, and therefore the bulletin will prove extremely helpful and interesting to those concerned with water supply. The subject of water supply is divided in two general headings—industrial water, potable water supply, and military field water supply. Several flowsheets help illustrate the booklet.

Circle letter (AA) on reply card.

(AB) TUBING ANCHOR

The Knowlton Oil Tool Company has published a 4-page bulletin showing its Type "K" tubing anchor. The new tubing anchor is designed for use in the double string above the Kobe free pump. An anchor is necessary in deep installations. After being set the anchor will not move down the well under any conditions unless unset by the operation, the company reported.



The Type "K" requires no rotation to set, only a pickup of 20 in. Any desired weight can be placed on the tool at any depth or slant, depending on the operator.

To set the Type "K" anchor the cage pin hangs in the middle off inside slot before the tool enters the well. Lower the strings to the well head. Pick up 20 in. plus additional inches for the amount of support desired from the anchor. Lower the strings again to the well head.

Setting process can be repeated until the exact weight that is desired is obtained on the anchor.

Circle letter (AB) on reply card.

(AC) SAFETY TOOLS

A new, 4-page booklet covering Ampco safety tools has just been released by Ampco Metal, Inc. Highly illustrated, this booklet contains factual information about safety tools representative of the Ampco line. Materials of construction and usage together with a cataloging of sizes, weights and other descriptive data are included in the new booklet.

Circle letter (AC) on reply card.

(AD) PRESSURE CONTROLLER

A new non-indicating pressure controller, known as the Honeywell pressure pilot, is fully described in Bulletin 16-1. The 8-page catalog covers the principle of operation, specifications, design features, mounting dimensions, and other pertinent information. Minneapolis-Honeywell Regulator Company.

Circle letter (AD) on reply card.

(AE) DIESEL ENGINES

Design and operation features of the Nordberg one, two, and recently introduced three cylinder Type 4FS diesel engines are illustrated and described in a new 12-page, two-color bulletin published by Nordberg Manufacturing Company. Built for continuous duty or standby service, the Nordberg 4FS diesel engines described in Bulletin 194 have a 4½-in. bore and 5¼-in. stroke and are of the four-cycle, vertical mechanical injection type. The units range from 10 to 45 hp within an operating speed range of 1200 to 1800 rpm. Nordberg 4FS diesel engines are offered as complete, self-contained, ready to operate units with generator, pump or power take-off for direct connection or belt drive.

Circle letter (AE) on reply card.

(AF) DRILL PIPE

Proper care of drill pipe is simply and briefly presented by The National Supply Company's Spang-Chalfant Division, with whimsical cartoons in a new pocket-sized booklet entitled, "How to Make Drill Pipe Last Longer." Intended for all who are engaged in drilling operations, this easy-to-read booklet quickly explains the causes of drill pipe failures. At the same time it recommends handling and operating practices that reduce these causes and thus prolong the life of drill pipe.

Circle letter (AF) on reply card.

(AG) ANTI-FRICTION BEARING

The Anti-Friction Bearing Distributors Association has recently announced that the "AFBDA Bearing Maintenance Report," which has been published during the past year by the Association, will again be offered during 1952 to men within industry as a service of the AFBDA and its members. It concentrates solely on the many and varied problems of maintenance of anti-friction bearings. The Association states that the bearing maintenance report will, in future issues, bring maintenance men the answers to many problems of bearing service which have rarely, if ever, been covered in any other publication.

Circle letter (AG) on reply card.

(AH) SYNCHRONOUS MOTORS

"Application of Direct-Connected Synchronous Motors to Reciprocating Compressors" is a reprint of a paper presented at the New York Section of A.I.E.E., Power & Industrial Division, Motor Selection and Application Course in December 1951. Written by G. L. Oscarson, chief application engineer, Electric Machinery Manufacturing Company, this discussion deals largely with consideration of proper rotor flywheel effect (WK^2) as a preventive measure for voltage fluctuations when driving reciprocating compressors with direct-connected synchronous motors. Examples complete with formulas, sample calculations, and reference curves are included in this booklet.

Circle letter (AH) on reply card.

(AI) OIL, GAS ENGINES

Ajax gas and oil engines in 7½ by 10 and 8½ by 10 CMA models for oil well pumping are illustrated and described in a new 4-page bulletin published by Ajax Iron Works. These engines are built for low operating costs and continuous service. A convertible model is offered that operates on approved, clean crude as well as fuel oil—making it particularly suitable for oil well pumping where natural gas is not available. Also included are specifications of various oil and gas types available.

Circle letter (AI) on reply card.

(AJ) TRANSFORMER, REACTORS

Southwestern Industrial Electronics Company has published an announcement sheet describing the first production units of its new line of miniature transformers and reactors. The company reports that these new transformers and reactors feature precision engineering, close tolerances (Standard ±5 per cent of master standard) (specials ±1 per cent of master standard; true hermetic sealing, and polished nickel Mu-Metal cases. Dimensions are 15/16-in. by 1⅛-in. by 1⅞-in., and weigh 3 oz.

Circle letter (AJ) on reply card.

(AK) RUST PREVENTIVES

Rust-Oleum Corporation has issued a complete general catalog. It is a 16-page, 2-color, publication, listing Rust-Oleum rust preventive application. Color chips used throughout the catalog illustrate the exact color. Detailed information and technical data complete with applications, resistance qualities, drying time, thinners, and special applications are included with each. The last two pages in the booklet are questions and answers on Rust-Oleum and its many features.

Circle letter (AK) on reply card.

(AL) STAINLESS VALVES

The Cooper Alloy Foundry Company announces the publication of a new periodical, *Valve Topics*, edited for those who design, specify, use, or purchase stainless steel valves and fittings. *Valve Topics* will be devoted exclusively to the task of providing information about the uses and abuses of stainless steel valves; application stories depicting how Cooper Alloy valves and fittings serve in industry; and special features.

Circle letter (AL) on reply card.

(AM) HARDFACING ROD

A new wall chart that details the proper hardfacing rod for the job has been released by the American Manganese Steel Division of the American Brake Shoe Company. The chart divides welding into basic operations, under which are listed the equipment parts to be Amscoated together with the recommended rod, available sizes, and preferred method of application. A fuller description of the uses of each rod also appears on the chart.

Circle letter (AM) on reply card.

(AN) AIR-MOVER

A new device for moving large volumes of air quickly and economically in situations requiring intermittent or emergency ventilation, is described in a new four-page bulletin published by Mine Safety Appliances Company. Portable and light-weight, the instrument is adaptable for use in industrial plants, mines, and wherever else circumstances make it necessary to remove air contaminants from confined areas or to introduce fresh air for safe ventilation or rapid cooling. The bulletin gives examples of its use in oil refineries, chemical companies, steel plants, mining operations, and others.

Circle letter (AN) on reply card.

(AO) WATER CONDITIONING

A new 20-page Bulletin 611, published by Elgin Softener Corporation, covers the various methods of conditioning water and the purposes served by each. It features an improved water softener of "double-check" design. It also tells how to make any water softener deliver from 3 to 10 times more soft water. A deionizer of single-tank design, which produces ultra-demineralized water at a fraction of distillation or evaporation cost, is described. Chemical feed, zeolite-post treatment, zeolite-alkalinity neutralization, and split-stream dealkalization systems for boiler, process and general water conditioning purposes are covered. Sections are devoted to latest type filters, purifiers, zeolites, and water treatment for all purposes.

Circle letter (AO) on reply card.

(AP) DIESEL ENGINE

How the production of 50,000,000 diesel horsepower by a single manufacturer can be regarded as an owner's insurance policy to assure top engine performance is told in a booklet just published by the Detroit Diesel Engine Division of General Motors. The booklet covers various design features of the GM 2-cycle diesel engine, action photographs of installations in the construction, transportation, marine, mining, oil well drilling, agricultural and industrial fields, and a map showing the division's widespread sales and service facilities throughout the country.

Circle letter (AP) on reply card.

(AQ) LUMMUS FACILITIES

"Meet the Lummus Company" is the title of a 16-page brochure just released by the firm's main office in New York. Following the format of previous issues in the series, the bulletin is profusely illustrated—31 photographs and visuals in all. It introduces the new, modern office building recently built and occupied by the company at Houston, Texas. Separate sections picture and describe each branch office, affiliate, laboratory and manufacturing arm of this world-wide firm. Text outlines scope of work performed by each, with photos of projected or completed plants as illustrations.

Circle letter (AQ) on reply card.

(AR) DATA BOOK

Beaver Pipe Tools, Inc., announces the completion of their new 1952 catalog and data book. The new catalog gives readers pertinent information on the three pipe and bolt machines: Model A, B and E; Power Units C-1 and C-2; ratchet threaders, reamers, cutters and other pipe tools in the hand and power classification. Four pages in the back of the catalog are devoted to the "Operating Guide" . . . produced by Beaver to assure users best results from pipe and bolt machines and hand tools. It is fully illustrated with pen and ink drawings and technical copy that tells how to locate and correct any pipe troubles that may come up.

Circle letter (AR) on reply card.

(AS) SPECTROPHOTOMETER

Instrumentation Data Sheet 10.16-2a, published by Minneapolis-Honeywell Regulator Company, describes the applicability, mode of operation, and salient features of the Beckman Model IR-2 and IR-2T spectrophotometer as used with Brown *ElectroniK* recorders. Also described in the data sheet is the direct transmittancy recording attachment for the Model IR-2 infrared spectrophotometer. Photographs of the equipment, schematic diagrams of the optical system and illustrations showing typical chart records of recorded analyses are included with the data sheet.

Circle letter (AS) on reply card.

(AT) V-BELTS

New improved Manhattan single groove V-Belts are described in a new bulletin issued by Raybestos-Manhattan, Inc., Manhattan Rubber Division. According to the manufacturer, Manhattan FHP belts embody an advanced design with straight sidewalls for more grip and with cords in the strength member held in a straight "power line" by a special "truss ply" of finely woven duck under the top cover. This is said to increase the life of the belt and the machine it drives by eliminating vibration. New standardized belt numbers and a list of standard sizes of belts are included in the bulletin.

Circle letter (AT) on reply card.

(AU) AIR-CLEANER

The Hankison Model B-30 Condensifilter, a device which dehydrates and cleans compressed air used for operating instruments, is detailed in a new two-page bulletin published by Hankison Corporation. Measuring only 15 in. high by 9 in. in diameter, the Condensifilter combines in a single unit—a mechanical filter, a dehydrator, and an automatic trap. When connected to a compressed air line, it removes entrained and vaporized water and oil, oil sludge, scale, and other foreign materials from the air. Rated capacity is 30 cu ft per minute at 100 psi, but when greater capacity or uninterrupted service is required, several units can be installed in parallel.

Circle letter (AU) on reply card.

(AV) WIRE ROPE

McWhyte Company has issued a new catalog called "McWhyte Safe-Lock Industrial Standards Wire Rope Assemblies." which illustrates and gives detailed specifications for wire rope with fittings permanently attached. Assemblies are used, for operating controls, as a part of machinery and equipment, and for slings and hoists. They are widely used on small gasoline powered equipment, mining machines, agricultural implements, automotive equipment, aircraft. laboratory equipment. etc.

Circle letter (AV) on reply card.

(AW) PIPING DESIGN

"How to use Schedule Numbers in Power Piping Design," by Sabin Crocker has been reprinted by Taylor Forge and Pipe Works and is now available. The paper will be interesting to all users of piping and particularly to those who are not familiar with the derivation of the schedule number system of designating pipe wall thicknesses. The chart in the article will be very useful, because the information is calculated on the basis of the new formulas that have been adopted both by the ASME boiler code and the ASA code for pressure piping. Also the data in this chart reflect the pipe wall tolerances and the designer can make his selections without having to convert from nominal wall to minimum wall.

Circle letter (AW) on reply card.

(AX) STANDBY POWER

Featured in "E-M Synchronizer" No. 35, quarterly publication of the Electric Machinery Manufacturing Company, is an article on standby or emergency power. Written by E. W. Kammerer, E-M Switchgear engineer, this article deals with the requirements of standby power, the types of service available, and a detailed discussion of controls for automatic start-stop operation. It is also fully illustrated with diagrams and typical installation pictures. Other articles in the generator number of the "E-M Synchronizer" include a discussion of turbine generator construction features, a generator selection chart, plotted to give generator KVA necessary when motor horsepower and allowable voltage drop are known, and a "Handy Selection Index for Engine-Driven A-C Generators." Electric Machinery Manufacturing Company.

Circle letter (AX) on reply card.

(AY) PROTECTIVE COATINGS

The David E. Long Corporation has published a brochure on its DEL protective coatings, together with an industrial price list. The folder briefly describes coatings that are the latest developments and have been proved in the field. It lists the different types of coatings and gives their particular features and whether they can be used most effectively.

Circle letter (AY) on reply card.

(AZ) OIL PURIFIERS

Continuous oil purifiers for the purification of diesel fuel oil, diesel and turbine lubricating oils, cutting, quenching and other industrial oils are covered in Bulletin No. 1264 recently published by the Sharpless Corporation. Utilizing the highest centrifugal force commercially available, these purifiers remove dirt, tank scale, and moisture from fuel oil; carbon particles and acid sludge from diesel lubricating oil; metal particles and dirt from industrial oils; and water-oil emulsions from turbine lubricating oil. Additives in the oil are not removed by centrifugal purification.

Circle letter (AZ) on reply card.

(BA) WELD FITTING

The Key Company of East Louis, Illinois, developers and manufacturers of a new line of alloy steel welding fittings has prepared a new bulletin on their "Key-Kast" products.

The new Key-Kest alloy welding fittings are based on an entirely new design of greater wall thickness throughout for increased structural strength . . . and extra thickness at critical areas for greater allowance against erosion and corrosion. The advantages this new design principle offers for alloy piping systems are explained graphically in the new bulletin, and the various alloys which will be available are also listed.

Circle letter (BA) on reply card.

Renew Old Drums in Just 7 Minutes!

THAT'S RIGHT! Used drums restored to like-new condition . . . cleaned, paint-stripped, rinsed, dried, and repainted . . . in just 7 minutes! That's how fast Oakite cleaning works in one barrel-house.

Oakite cleaning has three other advantages, too: **Fewer rejects . . . more uniform paint stripping . . . better adhesion for new paint.** No paint build-up on steam coils . . . no clogging of drains and sewers.

FREE BOOKLET tells how. Write Oakite Products, Inc., 48 Thames St., New York 6, N. Y.

SPECIALIZED INDUSTRIAL CLEANING

OAKITE

MATERIALS • METHODS • SERVICE

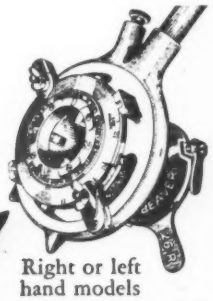
Technical Service Representatives Located in Principal Cities of United States and Canada

SIMPLICITY!

Low Upkeep Cost
Trouble-Free

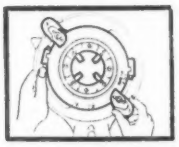
BEAVER NO. 26-R
1 TO 2-INCH PIPE THREADER

5 OUTSTANDING ADVANTAGES

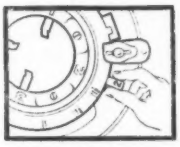


Right or left hand models

• The new Beaver 26-R is a greatly improved and simplified successor to the "old Beaver 26," popular for 40 years. Drive ring is on top—in line with dies for easy cutting. Oversize, undersize or standard threads can be cut of uniform length. Has "radio dial" setting. Change size in 2 seconds without tools. Standard taper or electric conduit threads. One set dies. No bushings.

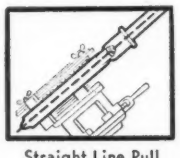


Radio Dial Setting Change in 2 Seconds

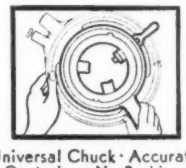


Dies Easily Removed from Outside

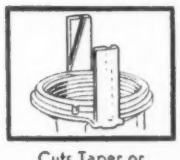
BEAVER PIPE TOOLS, INC.
256-300 DANA AVENUE • WARREN, OHIO, U. S. A.
"Over 50 Years of Friendly Service"



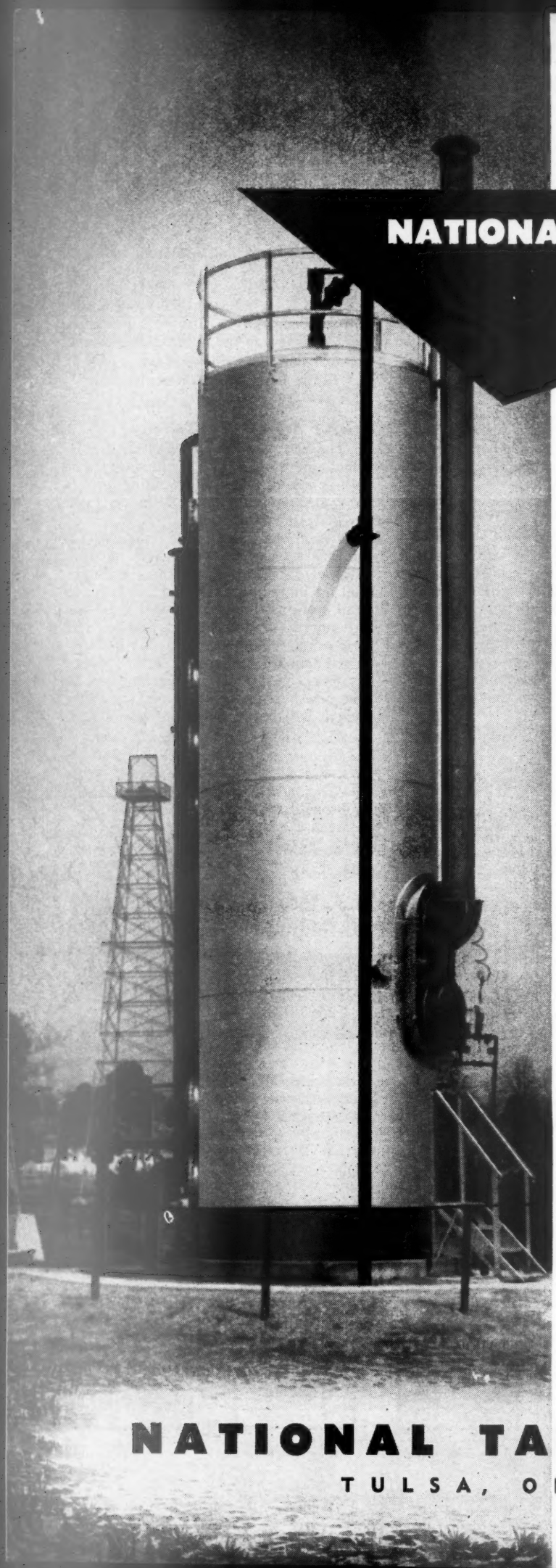
Straight Line Pull Easier Cutting



Universal Chuck · Accurate Centering · No Bushings



Cuts Taper or Straight Threads



NATIONAL ICP TREATER . . .

SAVES
$731.64 PER MONTH

Inter-Office Correspondence

To: [redacted] Date: April [redacted]

Subject: National ICP Treater
installed on our [redacted] Lease.

Dear Bud:

We thought you might be interested to know of the results obtained from the installation of the ICP Treater on our [redacted] Lease last September.

In figuring the amount of gas purchased for this lease, taking months comparable in weather conditions, six months before and six months after the installation, we find that in the preceding six months we bought gas in the amount of $1,298.99 and in the succeeding six months we purchased gas in the amount of $599.47 a total saving for six months of approximately $699.47 or $133.00 per month.

Before installing this Treater it was necessary that we clean ten tanks per month, losing approximately twenty barrels of oil each time. This would amount to 200 barrels per month or approximately $486.00 per month. This Treater has now been in service approximately eight months and we have not cleaned a single tank.

In addition to the gas and tank cleaning saving we also raised the gravity of the oil an average of 1°, which raised the price of the oil .02¢ per barrel. As this lease averaged 5,632 barrels of oil per month after installation of the Treater the amount gained on raising the gravity amounted to $112.64 per month.

We figure the total savings as follows:

$133.00 per month saving on gas.
$486.00 worth of oil saved each month.
$112.64 more per month for increased gravity.
$731.64 Total saving each month.

The first six months after installing this Treater we had saved $4,395.84. As the Treater cost $3,439.26, at the expiration of six months the Treater was paid for with $956.58 left over as profit.

Respectfully yours,

[redacted]

It's a National

NATIONAL TANK COMPANY

TULSA, OKLAHOMA